



IMPERIAL AGRICULTURAL
RESEARCH INSTITUTE, NEW DELHI.

THE AMERICAN PHILOSOPHICAL SOCIETY

HELD AT PHILADELPHIA
FOR PROMOTING USEFUL KNOWLEDGE

YEAR BOOK 1938

JANUARY 1, 1938 – DECEMBER 31, 1938



THE AMERICAN PHILOSOPHICAL SOCIETY
INDEPENDENCE SQUARE
PHILADELPHIA
1939

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I
CHARTER *
STATUTES AT LARGE OF PENNSYLVANIA
CHAPTER DCCCXCIV.

AN ACT

for incorporating the American Philosophical Society held
at Philadelphia for promoting useful knowledge.



Whereas the cultivation of useful knowledge, and the advancement of the liberal arts and sciences in any Country, have the most direct tendency towards the improvement of agriculture, the enlargement of trade, the ease and comfort of life, the ornament of society, and the increase and happiness of mankind; **And whereas** this country of North America, which the goodness of Providence hath given us to inherit, from the vastness of its extent, the variety of its climate, the fertility of its soil, the yet unexplored treasures of its bowels, the multitude of its rivers, lakes, bays, inlets, and other conveniences of navigation, offers to these United States one of the richest subjects of cultivation, ever presented to any people upon earth; **And whereas** the experience of ages shows that improvements of a public nature, are best carried on by societies of liberal and ingenious men, uniting their labours, without regard to nation, sect or party, in one grand pursuit, alike interesting to all, whereby mutual prejudices are worn off, a humane and philosophical spirit is cherished, and youth are stimulated to a laudable diligence and emulation in the pursuit of wisdom; **And whereas**, upon these principles,

* Original Charter, Granted in 1780. Articles of Amendment added 1935.

divers public-spirited gentlemen of Pennsylvania and other American States did heretofore unite themselves, under certain regulations, into one voluntary Society, by the name of "The American Philosophical Society held at Philadelphia, for promoting useful knowledge," and by their successful labours and investigations, to the great credit of America, have extended their reputation so far, that men of the first eminence in the republic of letters in the most civilized nations of Europe have done honour to their publications, and desired to be enrolled among their members; **And whereas** the said Society, after having been long interrupted in their laudable pursuits by the calamities of war, and the distresses of our Country, have found means to revive their design, in hopes of being able to prosecute the same with their former success, and being further encouraged therein by the public, for which purpose they have prayed us, "the Representatives of the Freemen of the Commonwealth of Pennsylvania," that they may be created One Body Politic and Corporate forever, with such powers, privileges, and immunities, as may be necessary for answering the valuable purposes which the said Society had originally in view.

Wherefore, in order to encourage the said Society in the prosecution and advancement of all useful branches of knowledge, for the benefit of their country and mankind.

[SECTION I.] **Be it enacted, and it is hereby enacted by the Representatives of the Freemen of the Commonwealth of Pennsylvania, in General Assembly met, and by the authority of the same, That** the Members of the said American Philosophical Society heretofore voluntarily associated for promoting useful knowledge, and such other persons as have been duly elected Members and Officers of the same, agreeably to the fundamental laws and regulations of the said Society, comprized in twelve sections, prefixed to their first volume of transactions, published in Philadelphia by William and Thomas Bradford in the year of our Lord one thousand seven hundred and seventy-one, and who shall in

all respects conform themselves to the said laws and regulations, and such other laws, regulations and ordinances, as shall hereafter be duly made and enacted by the said Society, according to the tenor hereof, be and forever hereafter shall be, One Body Corporate and Politic in Deed, by the name and style of "The American Philosophical Society held at Philadelphia, for promoting useful knowledge," and by the same name they are hereby constituted and confirmed One Body Corporate and Politic, to have perpetual succession, and by the same name they and their successors are hereby declared and made able and capable in law, to have, hold, receive, and enjoy lands, tenements, rents, franchises, hereditaments, gifts, and bequests of what nature so ever, in fee simple or for term of life, lives, years or otherwise, and also to give, grant, let, sell, alien, or assign the same lands, tenements, hereditaments, goods, chattels, and premises, according to the nature of the respective gifts, grants, and bequests, made to them the said Society, and of their estate therein. **Provided**, that the amount of the clear yearly value of such real estate do not exceed the value of ten thousand bushels of good merchantable wheat.

[SECTION II.] **And be it further enacted by the authority aforesaid**, That the said Society be, and shall be for ever hereafter able and capable in law to sue, and be sued, plead and be impleaded, answer and be answered unto, defend and be defended in all or any of the courts or other places, and before any Judges, Justices, and other person or persons, in all manner of actions, suits, complaints, pleas, causes, and matters, of what nature or kind so ever, within this Commonwealth; and that it shall and may be lawfull to and for the said Society, for ever hereafter to have and use one common seal in their affairs, and the same at their will and pleasure to break, change, alter and renew.

[SECTION III.] **And be it further enacted by the authority aforesaid**, That for the well governing of the said Society, and ordering their affairs, they shall have the following officers, that is to say, one Patron, who shall be his

Excellency the President of the Supreme Executive Council * of this Commonwealth, for the time being, and likewise one President, three Vice Presidents, four Secretaries, three Curators, one Treasurer, together with a Council of twelve members; and that on the first Friday of January next, between the hours of two and five in the afternoon, as many of the members of the said Society as shall have paid up their arrears due to the Society, and shall declare their willingness to conform to the laws, regulations and ordinances of the Society then duly in force, according to the tenor hereof, by subscribing the same, and who shall attend in the Hall or place of meeting of the said Society, within the time aforesaid, shall chuse by ballot, agreeable to the fundamental laws and regulations herein before referred to, one President, three Vice Presidents, four Secretaries, three Curators, and one Treasurer, and at the same time and place, the members met and qualified as aforesaid shall in like manner chuse four members for the Council, to hold their offices for one year, four more members for the Council to hold their offices for two years, and four more members for the Council, to hold their offices for three years. And on the first Friday in January, which shall be in the year of our Lord one thousand seven hundred and eighty-two, and so likewise on the first Friday of January, yearly and every year thereafter, between the hours of two and five in the afternoon, the Members of the said Society met and qualified as aforesaid, shall chuse one President, three Vice Presidents, four Secretaries, three Curators and one Treasurer, to hold their respective offices for one year, and four Council Men to hold their offices for three years; *Provided* that no person residing within the United States shall be capable of being President, Vice President, Secretary, Curator, Treasurer, or member of the Council, or of electing to any of the said offices, who is not capable of electing and being elected to civil offices within the State in which he resides. *Provided also*, that nothing herein

* [Now His Excellency the Governor of this Commonwealth.]

contained shall be considered as intended to exclude any of the said Officers or Councillors, whose times shall be expired, from being re-elected, according to the pleasure of the said Society; and of the day, hours and place of all such elections, due notice shall be given by the Secretaries, or some one of them, in one or more of the public newspapers of this State, agreeable to the said fundamental laws and regulations before referred to.

[SECTION IV.] **And be it further enacted by the authority aforesaid,** That the Officers and Council of the said Society shall be capable of exercising such power for the well governing and ordering the affairs of the Society, and of holding such occasional meetings for that purpose, as shall be described, fixed, and determined by the statutes, laws, regulations and ordinances of the said Society, hereafter to be made. *Provided always,* that no statute, law, regulation or ordinance shall ever be made or passed by the said Society, or be binding upon the members thereof, or any of them, unless the same hath been duly proposed, and fairly drawn up in writing, at one stated meeting of the Society, and enacted or passed at a subsequent meeting at least the space of fourteen days after the former meeting, and upon due notice in some of the public newspapers, that the enacting of statutes and laws, or the making and passing ordinances and regulations, will be part of the business of such meeting; nor shall any statute, law, regulation or ordinance be then or at any time enacted or passed, unless thirteen members of the said Society, or such greater number of members as may be afterwards fixed by the rules of the Society, be present, besides such quorum of the Officers and Council, as the laws of the Society for the time being may require, and unless the same be voted by two-thirds of the whole body then present; all which statutes, laws, ordinances and regulations, so as aforesaid duly made, enacted and passed, shall be binding upon every member of the said Society, and be from time to time inviolably observed, according to the tenor and effect thereof; pro-

vided they be not repugnant or contrary to the laws of this Commonwealth, for the time being in force and effect.

And whereas nations truly civilized (however unhappily at variance on other accounts) will never wage war with the Arts and Sciences, and the common Interests of humanity:

[SECTION V.] **Be it further enacted by the authority aforesaid,** That it shall and may be lawful for the said Society by their proper officers, at all times, whether in peace or war, to correspond with learned Societies, as well as individual learned men, of any nation or country, upon matters merely belonging to the business of the said Society, such as the mutual communication of their discoveries and proceedings in Philosophy and Science; the procuring books, apparatus, natural curiosities, and such other articles and intelligence as are usually exchanged between learned bodies, for furthering their common pursuits; **Provided always,** That such correspondence of the said Society be at all times open to the inspection of the Supreme Executive Council of this Commonwealth.

[Signed]

JOHN BAYARD,
Speaker.

Enacted into a Law at Philadelphia on Wednesday the fifteenth day of March anno Domini one thousand seven hundred and eighty.

[Signed]

THOMAS PAINE,
Clerk of the General Assembly.

COMMISSION FOR THE COMPILATION OF THE LAWS
OF PENNSYLVANIA PRIOR TO 1800.CLERK'S OFFICE,
1211 BETZ BUILDING.JAMES T. MITCHELL, }
HENRY FLANDERS, } *Commissioners.* CHAS. R. HILDEBURN, *Clerk.*

PHILADELPHIA, March 12, 1898.

Compared, revised and found to be a correct copy of the original enrollment in the archives of the Commonwealth, by me the custodian of the said original as clerk of the commissioners appointed under the act of May 19, 1887, entitled, AN ACT FOR THE COMPILATION AND PUBLICATION OF THE LAWS OF THE PROVINCE AND COMMONWEALTH OF PENNSYLVANIA PRIOR TO THE YEAR ONE THOUSAND EIGHT HUNDRED, P.L. 1887, pp. 129 and 130.

CHAS. R. HILDEBURN,
Clerk of the Commissioners.

Witness as to Chas. R. Hildeburn:

WM. NEWBOLD ELY,
JULIUS F. SACHSE.Sworn to and subscribed before me
this 19th day of May, 1898.JAMES P. STERRETT,
*Chief Justice of the Supreme Court
of Pennsylvania.*

ARTICLES OF AMENDMENT

ARTICLE I

Notwithstanding the Proviso at the end of the first paragraph following the preamble of this Charter, or any other proviso thereof, the Society shall have the capacity and authority without limitation by this Charter to purchase, take, receive, lease as lessee, take by gift, devise or bequest, or otherwise acquire, and to own, hold, use, and otherwise deal with any and all real or personal property, or any interest therein, wherever situated.

ARTICLE II

Any provisions of this Charter which are purely administrative in their nature, including those concerning the officers, the members of the council, and the date and time of meetings, may be altered by a law, regulation or ordinance of the Society duly adopted and not repugnant or contrary to the laws of this Commonwealth.

CERTIFICATE OF ACCEPTANCE

1. The name of the accepting corporation is The American Philosophical Society held at Philadelphia for promoting useful knowledge.

2. The American Philosophical Society was created by the Act of Assembly approved March 15, 1780, L.B. No. 1, 363.

3. The American Philosophical Society herewith accepts the Constitution of Pennsylvania and the provisions of the Nonprofit Corporation Law.

4. The acceptance made herewith was duly authorized by a meeting of the members called for that purpose, held in Philadelphia on the 6th day of December, 1935.

ROLAND S. MORRIS
President

C. F. SKINNER
Assistant Secretary



Filed this 12th day of
December, 1935

J. WARREN MICKLE

Deputy Secretary of the Commonwealth

Recorded in

Miscellaneous Corporation

Record Book 210, P. 125

II

LAWS

(As Amended April 24, 1936, April 22 and November 19, 1938)

CHAPTER I

Of the Members both resident and foreign: their classification, nomination, and election; suspension and forfeiture of membership.

ART. 1. The resident members of the Society are elected from among citizens or residents of the United States who have achieved distinction in the sciences or humanities, in letters, in the practice of the arts or of the learned professions, or in the administration of affairs. Their number may not exceed five hundred, nor may more than thirty be elected in any one year.

ART. 2. The foreign members of the Society are elected from among persons who are neither citizens nor residents of the United States, and who are of the greatest eminence for their attainments in science, letters, or the liberal arts. Their number may not exceed sixty, nor may more than eight be elected in any one year.

ART. 3. Every member, whether resident or foreign, shall be classified according to his expressed wishes, or in accordance with his principal activities or contributions to knowledge, in one of the following four classes: *

* In accordance with general usage, the following more or less clearly defined fields of science and learning within the four classes have been recognized by the Society in recent years: Class I. Mathematics; Astronomy; Physics; Chemistry; Engineering. Class II. Geology, Paleontology, Geography; Zoology, Anatomy; Botany, Bacteriology; Anthropology, Psychology; Physiology, Pathology; Medicine, Pharmacology, Surgery. Class III. Political Science, Economics and Statistics; Modern History; Jurisprudence; Administration, Government; Affairs. Class IV. Philosophy, Education; Ancient, Medieval and Cultural History; Archaeology; Philology and Languages; Literature, Fine Arts.

Class I. Mathematical and Physical Sciences

Class II. Geological and Biological Sciences

Class III. Social Sciences

Class IV. Humanities

ART. 4. In each of the four classes of members there shall be a Committee on Membership consisting of a Chairman and four others members, appointed by the President.

ART. 5. Nominations to membership shall be made in writing by the Committees on Membership, or they may be made by any five members of the Society and addressed to the Secretaries before November first in each year. Nominations shall be on blank forms provided for that purpose and shall specify the qualifications and principal activities or fields of learning of the nominees. In case of non-election nominations may be continued by the written endorsement of three of the proposers filed with the Secretaries before November first following; these nominations may be continued a second time in similar manner, after which the names of the unsuccessful candidates will be dropped and all papers relating thereto destroyed. Such candidates may be considered again only by entirely new nominations.

ART. 6. Before December first in each year the Chairman of each Committee on Membership shall submit to the members of his class a list of all the nominations in the class and shall request them to use this list as a *preliminary ballot* and to check on it the names of those persons, not more than twelve in number, whom they prefer for resident members, and not more than five whom they prefer for foreign members, and to sign and return this ballot to the Secretaries before January first.

ART. 7. Before February first each Committee on Membership shall select from among those nominees having a high number of votes in the *preliminary ballot* not more than twelve for resident membership and not more than five for foreign membership in each class, due regard being given to a proper representation of the various subjects within the class.

ART. 8. It shall be the duty of each Committee on Membership to prepare, with such outside assistance as it may choose, a brief biographical sketch of each of the nominees so selected, listing his profession, position, qualifications, and important publications or contributions to science, literature, art or affairs. The names of these nominees, together with the biographical sketch of each, shall then be printed in alphabetical order under each class, and shall be sent confidentially to all members of the Society not later than March first. Members shall be invited to return to the Secretaries before April first a *preference ballot* on which they have checked the names of not more than thirty nominees for resident membership and of not more than eight for foreign membership.

ART. 9. The Council at the meeting next preceding the General Meeting of the Society in the month of April, notice of which shall be given at least two weeks in advance, shall select by ballot from the list of nominees residing within the United States a number not exceeding thirty, and of non-residents of the United States a number not exceeding eight, to be recommended to the Society for election. In this selection special weight shall be given to the votes of members in the preference ballot. The names of the nominees so chosen, arranged alphabetically in classes, shall be reported to the Society at its next ensuing session.

ART. 10. Election to membership, both resident and foreign, shall be by ballot at the General Meeting of the Society in the month of April. A two-thirds vote of those present and voting shall be necessary to elect.

ART. 11. The members are mutually pledged not to mention to non-members of the Society the name of any nominee proposed, or of any withdrawn or unsuccessful nominee.

ART. 12. Every person who is elected a resident or foreign member shall signify his acceptance in writing within one year after the mailing of notification of such election. In default of such acceptance the election shall be void.

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ART. 13. The formal admission of a member into the Society shall be at his first attendance at a meeting of the Society after his election and in the manner and form following: He shall subscribe the Laws in the Roll Book and be introduced to the President, who, taking him by the hand, shall say:

"By the authority and in the name of the American Philosophical Society held at Philadelphia for Promoting Useful Knowledge, I do admit you a Member thereof."

ART. 14. The Society may from time to time assess membership dues in accordance with its needs and policies. Any person who shall refuse or neglect to pay such assessment for two years, after two or more notifications from the Treasurer, shall be reported to the Society as delinquent and his name shall be stricken from the roll of members.

ART. 15. The membership of any resident or foreign member may, for good and sufficient cause, and upon recommendation by the Council, be terminated by the Society at a General Meeting by a vote of two-thirds of the members attending, provided, however, that the total number of members so attending shall be not less than thirty.

CHAPTER II

Of the Patron and Elective Officers; qualifications, nominations and elections, terms of office, suspension or removal, vacancies.

ART. 1. The Governor of Pennsylvania shall be ex-officio the Patron of the Society.

ART. 2. The elective Officers of the Society shall be a President, three Vice-presidents, two Secretaries, a Curator, a Treasurer, and twelve Councillors.

ART. 3. No person save the Treasurer, who may be a Corporation, shall be capable of holding any elective office as defined above, who is not a citizen of the United States.

ART. 4. Nominations to the elective offices of the Soci-

ety are made by the Committee on Nominations as herein-after provided, and may also be made by petition signed by not less than twenty members, in such manner as may be prescribed by the Committee on Nominations and approved by the Council.

ART. 5. The election of Officers shall be held at the General Meeting in the month of April at a time duly announced in the program. The election shall be by ballot, a majority of all ballots cast being requisite for election. In the event that no candidate for a given office shall receive such a majority, a second ballot shall be taken and election shall be by plurality of votes cast.

ART. 6. The terms of all elective Officers, except Councillors, are of one year, commencing upon the close of the General Meeting at which they are elected. They shall serve until the election and acceptance of their successors and are eligible for reelection.

ART. 7. The terms of Councillors are of three years, commencing upon the close of the General Meeting at which they are elected. They shall serve until the election and acceptance of their successors, but are ineligible for reelection until one year after the expiration of their terms of office.

ART. 8. Any elective Officer may be suspended or removed from office, for good and sufficient cause, at a meeting of the Council, by a vote of two-thirds of all its members.

ART. 9. A vacancy occurring in any elective office may be filled for the unexpired term by vote of a majority of the Council.

CHAPTER III

Of the Officers and their duties

ART. 1. The PRESIDENT shall preside at the meetings of the Society and Council; he shall appoint all committees, and designate their chairmen, except as otherwise pro-

vided in the Laws, and shall be ex-officio a member of all committees except the Committee on Nominations.

ART. 2. The VICE-PRESIDENTS shall preside at meetings of the Society and Council, in the absence of the President, in rotation in order of seniority of continuous service. In the event of the death or disability of the President, the senior Vice-president shall act as President until the vacancy shall be filled.

ART. 3. The SECRETARIES shall have the custody of the Seal of the Society, shall record the proceedings of the Society and the Council, shall notify all acts of the Society and the Council to those concerned, shall conduct the correspondence of the Society and Council, shall maintain the authentic list of resident and foreign members, and shall have the custody of the Society's files and records. The Secretaries shall arrange among themselves each year as to the distribution and performance of their duties, and shall report such arrangement to the Council; they shall also have power to delegate the performance of their duties to the Assistant Secretary or Executive Officer.

ART. 4. The CURATOR shall have charge of the Cabinet, and shall supervise the maintenance, exhibit, and use of the Society's collections, and shall advise the Council with respect to their increase, disposal, or temporary loan. He shall be ex-officio a member of the Committee on the Hall.

ART. 5. The TREASURER may be a person, as defined in Chap. II, Art. 3, or a trust company or other suitable financial corporation of the State of Pennsylvania. He shall collect and receive all moneys due or payable to the Society or entrusted to its care, and all gifts and bequests made to it. He shall pay all bills due by the Society when properly approved, in accordance with appropriations authorized by the Society or the Council, or in accordance with the terms of trust funds established for specific purposes. He shall deposit the funds and securities of the Society in its name with such banks or trust companies in

the State of Pennsylvania as may be approved by the Committee on Finance.

ART. 6. The Treasurer shall keep accounts in good and regular order of all receipts and expenditures and of all moneys or other property in his hands, and shall report them, and present them for audit, as may be required by the Committee on Finance.

ART. 7. The Treasurer may, if authorized by vote of the Committee on Finance, employ an assistant treasurer or a trust company or other suitable financial corporation of the State of Pennsylvania, approved by the Committee on Finance, for the performance of such duties as may be delegated to such agent.

ART. 8. The Treasurer shall give bond, at the expense of the Society, for the faithful execution of all his trusts, in such amount as may be required by the Committee on Finance.

ART. 9. The Treasurer shall, upon the expiration of his term of office, deliver over to the Committee on Finance, for transmittal to his successor, the books, papers, moneys, and property remaining in his hands.

CHAPTER IV

Of the Council and the Annual Budget

ART. 1. The COUNCIL shall consist of the Officers, the twelve Councillors, and the Chairmen of the Committees on Finance, Research, Publications, Library and Hall.

ART. 2. The Council shall hold at least three meetings a year, and nine members shall constitute a quorum at any meeting, provided, however, that for the adoption of the budget a vote of a majority of all the members shall be requisite. Minutes of the proceedings and acts of the Council shall be regularly kept.

ART. 3. The Council shall make recommendations for membership in the Society as provided in Chap. I, Art. 9, of the Laws, and elect members of the Committees on Re-

search and Publications as provided in Chap. 5, Arts. 5 and 8.

ART. 4. The Council shall, at such time as they may fix, ask all Committees to submit estimates of their needs for the ensuing fiscal year which, together with the report of receipts and expenditures by the Committee on Finance, shall be made the basis for the annual budget to be submitted by the Council to the Society for its approval at the General Meeting in April.

ART. 5. The Council shall have power to take action for the Society in legal matters, to manage its affairs, and to assume its administration, to make contracts or to authorize them to be made in the name of the Society, except as otherwise provided.

ART. 6. The Council shall require reports to be presented to it at least once a year by such officers, committees, and employees of the Society as they may designate, or as may be required by the Laws to present such reports, and shall, through the President, present an annual report to the Society on the state of its affairs.

ART. 7. The Council shall have power to appoint an administrative executive officer, and to fix his term of service, duties and compensation.

CHAPTER V

Of the Committees of the Society

ART. 1. There shall be four COMMITTEES ON MEMBERSHIP, one in each class, each composed of five members whose appointment and duties are prescribed in Chap. I, Arts. 4-8.

ART. 2. There shall be a COMMITTEE ON FINANCE, consisting of the President and Treasurer, ex-officio, and not fewer than five other members who shall be nominated by the President and elected by the Society at the General Meeting in April. A majority of the Committee shall constitute a quorum at any meeting. The Committee shall

keep a record of all its acts and proceedings, which shall be communicated to the Council.

ART. 3. The Committee on Finance shall have the general superintendence of the financial concerns of the Society. It shall have the custody and control of all the securities and investments of the Society, both real and personal, with full power and authority to buy and to sell, and to invest and reinvest the same; including the power to purchase and to sell real estate and to make leases thereof, to satisfy mortgages and extinguish ground rents, and to direct the placing of all such insurances as it may deem necessary; as well as to borrow on the credit of the assets of the Society, to create mortgages thereon, and to make such improvements, repairs and alterations to real estate as it may deem necessary. It shall have power to authorize the proper Officers of the Society to execute the necessary papers to effect all purchases, sales and assignments of property, both real and personal; to execute and to satisfy mortgages, to extinguish ground rents and to transfer registered securities; to subscribe to bond-holders' agreements to plans of reorganization involving any securities held by the Society or in which it has an interest, and to do all such acts as are necessary in pursuance of the foregoing powers.

ART. 4. The Committee on Finance shall always have access to the Treasurer's books, accounts, and vouchers, and shall cause an audit of such accounts to be made at least once a year. It shall require from the Treasurer an annual report of all the operations of the treasury, which it shall present to the Council with an annual statement of estimates of receipts and expenditures. With the approval of the Council it shall determine the fiscal year of the Society and, in case of emergency needs, authorize appropriations over and above the annual budget.

ART. 5. There shall be a COMMITTEE ON RESEARCH, consisting of the President, ex-officio, and of not fewer than six other members, representative of the four classes, who shall serve for three years and who shall be nominated by

the President and elected by the Council. A majority of the Committee shall constitute a quorum at any meeting, and shall be requisite for any vote disposing of funds that may be allotted to the Committee. The Chairman, or a member designated by the Chairman, of the Committee on Publications, and of the Committee on Meetings, may sit with the Committee on Research but shall not vote.

ART. 6. The Committee on Research shall, with the approval of the Council, prescribe regulations for receiving and considering proposals for the advancement of knowledge through investigation. It may take such action as it shall see fit with respect to proposals received by it, and may, with the approval of the Council, itself initiate and cause to be executed investigations for the advancement of knowledge. It shall certify to the Treasurer all disbursements to be made from funds appropriated to it by the Council, and may allot therefrom such sums as it may see fit, on such conditions as it may prescribe, for the investigations approved by it. It shall require reports of the expenditures of all sums so allotted, and of the progress of all investigations aided thereby. It may withhold assistance in the event that the said reports are judged unsatisfactory.

ART. 7. The Committee on Research shall report all its acts to the Council, and from time to time submit reports to the Society on the progress of the investigations aided by it, and on the contributions to the advancement of knowledge made by them.

ART. 8. There shall be a COMMITTEE ON PUBLICATIONS, consisting of the President, *ex-officio*, and of not fewer than six other members, representative of the four classes, who shall serve for three years, and who shall be nominated by the President and elected by the Council. A majority of the Committee shall constitute a quorum at any meeting, and shall be requisite for any vote disposing of funds that may be allotted to the Committee. The Chairman, or a member designated by the Chairman, of the Committee on

Research and of the Committee on Meetings, may sit with the Committee on Publications but shall not vote.

ART. 9. The Committee on Publications shall supervise the contents, editing, printing, publication, distribution, and sale of all publications issued by the Society or in its name. It shall have power to employ necessary editorial assistance, and, with the approval of the Council, to appoint an Editor and to determine his duties and fix his compensation. It shall cause the necessary contracts for the manufacture of the Society's publications to be drawn up and executed. It shall certify to the Treasurer all bills which it shall have examined and approved for expenses attending the publications, as well as all disbursements to be made from funds appropriated to the Committee by the Council.

ART. 10. The Committee on Publications shall, with the approval of the Council, prescribe regulations for receiving and considering proposals for publication, and may take such action as it shall see fit with respect to proposals so received, including the allotment of funds appropriated to the Committee by the Council. The Committee shall have power to appoint referees or special sub-committees to assist it in the examination of material presented to it for publication and, in its discretion, to give honoraria for services so rendered. It shall report all its acts to the Council.

ART. 11. There shall be a COMMITTEE ON MEETINGS, consisting of the President, ex-officio, and of not fewer than four other members representative of the four classes. The Committee shall be appointed by the President and shall have power to add to its numbers. A majority of the Committee shall constitute a quorum at any meeting and shall be requisite for any vote disposing of funds that may be allotted to the Committee. The Chairman, or a member designated by the Chairman, of the Committee on Research and of the Committee on Publications, may sit with the Committee on Meetings but shall not vote.

ART. 12. The Committee on Meetings shall be charged with the preparation of the scientific and scholarly programs of all meetings of the Society, and of all meetings held under its auspices, and with the organization of discussions, symposia, and conferences. It shall have power to name special sub-committees to assist it, and to invite suitable persons, whether members of the Society or not, to participate in such programs, discussions, symposia, etc. The Committee shall have power to use such funds as may be appropriated to it by the Council for defraying the expenses of the programs, discussions, etc., organized by it, and shall certify to the Treasurer all disbursements to be made from such funds.

ART. 13. The Committee on Meetings shall transmit to the Committee on Publications all papers, communications, reports, and other materials which it may recommend for publication.

ART. 14. There shall be a COMMITTEE ON LIBRARY, consisting of the President, ex-officio, and of not fewer than six other members, representative of the four classes, who shall serve for three years and who shall be appointed by the President.

ART. 15. The Committee on Library shall supervise the administration of the Library, and shall, with the approval of the Council, prescribe regulations for its government and use. The Committee shall have power, with the approval of the Council, to employ a Librarian, determine his duties, and fix his compensation. It shall have charge of the exchange of publications, and shall have power to expend income of trust funds established specifically for purposes of the Library. The Committee shall prepare estimates of expenditures for the maintenance and increase of the Library, and shall certify to the Treasurer all bills properly payable and all disbursements to be made from funds appropriated by the Council for the purposes of the Library.

ART. 16. There shall be a COMMITTEE ON HALL, consisting of the President and Curator, ex-officio, and such other members as may be appointed by the President. They shall serve for three years and shall have charge of the Hall of the Society and of its furniture and fixtures and shall direct all necessary repairs.

ART. 17. There shall be a COMMITTEE ON NOMINATION OF OFFICERS consisting of five members,—a Chairman, appointed by the President, and the four Councillors who are entering the third year of their term of service.

ART. 18. The Committee shall, not later than December first, invite all members of the Society to submit to it informal suggestions for nominations to all offices to be filled by election at the next General Meeting.

ART. 19. The Committee shall then communicate to all members of the Society, not later than February first, a report presenting one nomination to each office to be filled by election at the next General Meeting. Nominations may also be made by petition if signed by twenty or more members and submitted to the Chairman not later than March first. Notice of such nomination must be sent to all members by April first.

ART. 20. The Committee shall prepare for use in the elections at the General Meeting a ballot in which shall be included, under each position to be filled by election, the name of the Committee's nominee, and the names, in alphabetical order, of any nominees included in petitions duly received in accordance with the Laws.

CHAPTER VI

On the Meetings of the Society

ART. 1. The Annual General Meeting shall be held in the month of April on days designated by vote of the Council, adopted at least three months before the date fixed therefor, at which it shall be lawful to transact all business not in contravention of the Laws.

ART. 2. The Autumn General Meeting shall be held on days designated by vote of the Council, usually in the month of November, at which it shall be lawful to transact all business not in contravention of the Laws.

ART. 3. Special meetings may be called at any time by order of the President, or, in his absence or disability, by order of a Vice-president, or by vote of the Council, for the consideration of matters of scientific or scholarly interest or for the transaction of such business as shall be specified in the order or vote calling the meeting.

CHAPTER VII

Of the Publications of the Society

ART. 1. The publications of the Society shall consist of PROCEEDINGS, TRANSACTIONS, MEMOIRS, YEAR BOOK, and of such other serial or separate publications as may be authorized by the Council upon recommendation by the Committee on Publications.

ART. 2. The PROCEEDINGS shall contain papers that are read before the Society at its meetings and that have been approved by the Committee on Publications. Other papers from whatever source may also be published in the PROCEEDINGS if approved by this Committee. The PROCEEDINGS will be distributed without charge, as issued, to the members who request it.

ART. 3. The TRANSACTIONS shall consist of contributions in the form of monographs, treatises, collections of documents, and other materials, approved by the Committee on Publications. The TRANSACTIONS shall be issued in complete parts, one or more of which may constitute a volume. They may be supplied to any member on such conditions or terms as may be prescribed by the Committee on Publications.

ART. 4. The MEMOIRS shall consist of works approved by the Committee on Publications. They shall be issued in such form as shall make possible their assembly in vol-

umes according to subject matter, or to fields of knowledge. They may be supplied to any member on such conditions or terms as may be prescribed by the Committee on Publications.

ART. 5. The YEAR BOOK shall contain, among other items, the Charter and Laws, list of Officers and Committees, the annual report of the President and Officers, important acts of the Society and Council, reports of all standing Committees, a catalogue of prizes, premiums and lectureships, lists of all members together with those elected and those deceased during the year, and obituaries of deceased members. It shall be published as soon as possible after the close of each calendar year and shall be sent gratis to all members of the Society.

CHAPTER VIII

Of the Laws of the Society and their Amendment

ART. 1. No amendment or supplement to these laws, nor any new law shall be made or passed by the Society, unless the same has been duly proposed in writing at a Stated Meeting of the Society and enacted at the subsequent General Meeting; due notice of the proposed law or amendment having been sent by mail at least fourteen days before the said General Meeting to the members qualified to vote thereon.

ART. 2. At the General Meeting no amendment or supplement to these laws shall be made, nor shall any new law be made, unless there be present a quorum of at least twenty members, of whom not fewer than five shall be members of the Council, and the same be voted by two-thirds of the whole body present.

III
OFFICERS AND STANDING COMMITTEES
1938-1939

OFFICERS

PATRON

THE GOVERNOR OF PENNSYLVANIA

PRESIDENT

ROLAND S. MORRIS

VICE-PRESIDENTS

EDWIN G. CONKLIN

ROBERT A. MILLIKAN

CYRUS ADLER

SECRETARIES

JOHN A. MILLER

WILLIAM E. LINGELBACH

CURATOR

ALBERT P. BRUBAKER

TREASURER

FIDELITY-PHILADELPHIA TRUST COMPANY

EXECUTIVE OFFICER

EDWIN G. CONKLIN

COUNCILLORS

Elected in 1936

JOSEPH ERLANGER

MAX FARRAND

MARSHALL S. MORGAN

GEORGE H. PARKER

Elected in 1937

EDWARD CAPPS

LUTHER P. EISENHART

ALFRED N. RICHARDS

JOHN M. SCOTT

Elected in 1938

WILLIAM F. ALBRIGHT

ARTHUR L. DAY

FRANK A. FETTER

HAROLD C. UREY

STANDING COMMITTEES

The President is ex-officio a member of all committees except the Committee on Nomination of Officers. The first member named in each committee is Chairman. The Executive Officer sits with all committees but does not vote unless regularly a member.

FINANCE

WILLIAM P. GEST †
 THOMAS S. GATES
 JOHN S. JENKS
 MARSHALL S. MORGAN
 GEORGE W. NORRIS
 CHARLES J. RHOADS
 J. HENRY SCATTERGOOD

HALL

J. BERTRAM LIPPINCOTT
 PAUL P. CRET
 LAWRENCE J. MORRIS
 J. RODMAN PAUL
 JOHN M. SCOTT
 ALBERT P. BRUBAKER, Curator

RESEARCH

EDWIN G. CONKLIN
 WILLIAM F. ALBRIGHT
 ARTHUR F. BUDDINGTON
 EDWARD P. CHEYNEY
 GILBERT CHINARD
 JOHN A. MILLER
 ALFRED N. RICHARDS
 W. F. G. SWANN
 HUGH S. TAYLOR

PUBLICATIONS

CYRUS ADLER
 FRANK AYDELOTTE
 EDWIN G. CONKLIN
 JOHN A. MILLER
 ERNEST M. PATTERSON
 JACOB R. SCHRAMM
 HAROLD C. UREY
 JAMES T. YOUNG
 ARTHUR W. GOODSPEED, Editor

MEETINGS

EDWIN G. CONKLIN
 CYRUS ADLER
 RALPH E. CLELAND
 KARL K. DARROW
 MERKEL H. JACOBS
 WALDO G. LELAND
 WILLIAM E. LINGELBACH
 JOHN A. MILLER
 JESSE S. REEVES
 HARLOW SHAPLEY
 HUGH S. TAYLOR

LIBRARY

ST. GEORGE L. SIOUSSAT
 GEORGE A. BARTON
 RHYNS CARPENTER
 WALDO G. LELAND
 WILLIAM E. LINGELBACH
 HORACE C. RICHARDS
 A. S. W. ROSENBAUGH
 HARLOW SHAPLEY

† Deceased January 12, 1939.

COMMITTEES ON MEMBERSHIP

CLASS I. MATHEMATICAL
AND PHYSICAL SCIENCES

W. F. G. SWANN
DONALD H. ANDREWS
WILLIAM F. DURAND
LUTHER P. EISENHART
HARLOW SHAPLEY

CLASS II. GEOLOGICAL AND
BIOLOGICAL SCIENCES

DETLEV W. BRONK
EDWARD W. BERRY
CHARLES B. DAVENPORT
BRADLEY M. DAVIS
EARNEST A. HOOTON

CLASS III. SOCIAL SCIENCES

ERNEST M. PATTERSON
CHARLES A. BEARD
EDWARD P. CHEYNEY
EDWARD S. CORWIN
WILLIAM P. GEST †

CLASS IV. HUMANITIES

WALDO G. LELAND
WILLIAM F. ALBRIGHT
GILBERT CHINARD
JOSIAH H. PENNIMAN
WILLIAM LYON PHELPS

COMMITTEE ON NOMINATION OF OFFICERS

ARTHUR W. GOODSPEED, Chairman

JOSEPH ERLANGER	} Retiring Councillors
MAX FARRAND	
MARSHALL S. MORGAN	
GEORGE H. PARKER	

† Deceased January 12, 1939.

CALENDAR FOR THE YEAR 1938-1939

STATED MEETINGS OF THE SOCIETY

1938

November 18-19. Autumn General Meeting

November 18, 10 A.M.-1 P.M. Symposium on "Intrinsic and Environmental Factors in American Population Growth" under the auspices of the Population Association of America.

2-4 P.M. Round Table Discussion.

4 P.M. Stated Meeting of Council.

6:45 P.M. Dinner for Members and Invited Guests.

8:15 P.M. Public Lecture followed by Reception.

November 19, 9:30-10:30 A.M. Executive Session.

10:30 A.M.-1 P.M., 2-4 P.M. Open Sessions for Reading of Papers and Reports of Research aided by Grants.

1939

February 16-17. Mid-winter Meeting.

February 16. Elihu Thomson Memorial Meeting.

2 P.M. Six papers on various aspects of his life and work.

8:15 P.M. Three addresses on Elihu Thomson, in the Hall of the Franklin Institute.

February 17. Joint Meeting with the Franklin Institute.

10 A.M.-1 P.M., 2-4 P.M. Symposium on "Progress in Astrophysics."

8:15 P.M. Public Lecture in the Hall of the Franklin Institute.

April 20-22. Annual General Meeting.

April 20, 10 A.M. Open Session for Reading of Papers.

2 P.M. Open Session for Reading of Papers.

8:30 P.M. Annual Meeting of Council.

April 21, 10 A.M. Executive Session and Annual Election.

2 P.M. Open Session for Reading of Papers.

8:15 P.M. R. A. F. Penrose, Jr., Memorial Lecture.

April 22, 10 A.M. Open Session for Reading of Papers.

2 P.M. Closed Session for Discussion of Society's Activities.

7:30 P.M. The Annual Dinner.

IV

ABSTRACTS FROM THE MINUTES OF THE MEETINGS OF THE SOCIETY DURING 1938

JOINT MEETING WITH REPRESENTATIVES OF ORGANIZA- TIONS AND INSTITUTIONS CONCERNED WITH THE PUBLICATION OF RESEARCH FEBRUARY 18, 19, 1938

Friday, February 18, 10 A.M.-1 P.M.; 2-4 P.M.

ROUND TABLE CONFERENCE

EDWIN G. CONKLIN, Vice-president, in the Chair

Jacob R. Schramm,¹ Recently Editor-in-chief, Biological Abstracts, Professor of Botany and Director, Department of Botany, University of Pennsylvania, and

Robert C. Binkley, Chairman, Joint Committee on Materials for Research of the American Council of Learned Societies and Social Science Research Council, opened the discussion of the following subjects:

1. Possible Economies in the Conventional Methods of Publishing.
2. Auxiliary Methods of Publishing.

The following members and guests took part in the discussion: J. R. Schramm, J. D. Tamarkin, E. D. Merrill, R. C. Binkley, John K. Wright, Sam F. Trelease, W. T. Couch, Albert Boni, Roland G. Kent, Percy W. Long, E. L. Richardson, Hugh S. Taylor, S. W. Fernberger, H. A. Barton, Eugene B. Power, Watson Davis, Waldo G. Leland, Hugo Dalsheimer, Cyrus Adler, A. F. Blakeslee, Edwin G. Conklin, F. R. Moulton, Conyers Read, Charles F. Rush.

Friday, February 18, 8:15 P.M.

Addresses,² by Dumas Malone, Director, Harvard University Press. "The Scholar and the Public."

¹ PROC. AMER. PHILOS. SOC. 80: 1-24.

² Ibid., 25-36; 37-47.

Donald P. Bean, Director, University of Chicago Press. "The Riddle of Research."

Saturday, February 19, 9:30 A.M.

EXECUTIVE SESSION

ROLAND S. MORRIS, President, in the Chair

The following resolution in appreciation of Mr. Eldridge Reeves Johnson's authorization of the transfer of his gift of \$500,000 for a new building to the endowment of the Society was unanimously adopted by a rising vote of thanks:

Resolved, That the President and Council of the American Philosophical Society are deeply appreciative of the gracious action of the representative of Mr. Eldridge Reeves Johnson in authorizing the American Philosophical Society to transfer the sum of \$500,000 which was given in 1929 for a new building for the Society to the endowment of the Society and with it to set up the Eldridge Reeves Johnson Fund for the Promotion of Useful Knowledge. With the income from this fund it will be possible for the Society to support many important projects of research in some of which Mr. Johnson was particularly interested.

We beg to express to Mr. Johnson and to the members of his family our high appreciation of this generous and very timely addition to the research funds of the American Philosophical Society.

The Secretary read the names of members who had died since the last meeting¹ while those present stood in respect to their memory.

Dr. Frederick P. Keppel, President of the Carnegie Corporation of New York, inquired through President Morris whether the Society would be willing to sponsor an inquiry regarding methods of developing amateur science and scientists in adult education. After some discussion it was unanimously recommended that the Officers and Councillors of the Society be authorized to communicate with Dr. Keppel expressing the Society's willingness to co-operate in every way possible in making this survey.

The Council presented a recommendation that an appropriation not to exceed \$5,000 be made to cover the cost of an engineer's report on the condition of the old Custom House with a view to utilizing this building for a library building. After some con-

¹ See p. 354.

sideration, it was recommended that an appropriation not to exceed \$2,000 be made to cover the cost of this report.

The following resolution in appreciation of our late Vice-president, Henry Herbert Donaldson, was unanimously adopted by a rising vote:

Resolved, That the American Philosophical Society hereby records its deep sorrow and sense of loss in the death on January 23, 1938, of its Vice-president and Chairman of the Committee on Publications, Dr. Henry Herbert Donaldson. Dr. Donaldson was elected a member of the Society in 1906. He served as a member of the Council, 1911-13, 1915-17, 1928-31, 1932-35, and as Vice-president from 1935 until his death. He was Chairman of the Committee on Publications since 1932 and it was on his suggestion that our new series of MEMOIRS was instituted. During his Chairmanship of the Committee on Publications he was instant in season and out of season in the service of the Society and took a very active part in the acceptance of papers offered and in the guidance of the work of the Committee. The American Philosophical Society in his death has lost a devoted member and all his acquaintances a charming and courteous friend. We extend to the members of his family our sincere sympathy in their bereavement and order that this memorandum be entered in our Minutes and a copy sent to his family.

Proposed amendments to the Laws were submitted by Dr. Conklin and it was voted that copies of these amendments be sent to each member of the Society and that they be presented at the next General Meeting in accordance with the Laws.

Saturday, February 19, 10:30 A.M.

ROLAND S. MORRIS, President, in the Chair

A General Discussion¹ on the Publication Program of the American Philosophical Society and Proposals for its Improvement was led by the following members:

Class I. Mathematical and Physical Sciences.

Henry Norris Russell, Professor of Astronomy and Director, Princeton University Observatory.

Hugh S. Taylor, Professor of Physical Chemistry and Chairman, Department of Chemistry, Princeton University.

W. F. G. Swann, Director, Bartol Research Foundation of the Franklin Institute.

¹ See p. 83.

Class II. Geological and Biological Sciences.

Edwin G. Conklin, Professor Emeritus of Biology, Princeton University.

Albert F. Blakeslee, Director, Department of Genetics, Carnegie Institution of Washington, Cold Spring Harbor.

Class III. Social Sciences.

Ernest M. Patterson, Professor of Economics, University of Pennsylvania.

Edwin S. Corwin, Professor of Jurisprudence, Princeton University.

William E. Lingelbach, Professor of Modern European History, University of Pennsylvania.

Conyers Read, Professor of English History, University of Pennsylvania.

Class IV. Humanities.

Waldo G. Leland, Permanent Secretary, American Council of Learned Societies.

ANNUAL GENERAL MEETING

April 21, 22, 23, 1938

Thursday, April 21, 10 A.M.

ROLAND S. MORRIS, President, in the Chair

Irving W. Bailey, Frederick H. Seares, Harlow Shapley and George Grafton Wilson, formerly elected members, subscribed the Laws and were admitted into the Society.

The following papers were read by the persons named:

Ernest W. Brown,* Professor Emeritus of Mathematics, Yale University, and W. J. Eckert. "The Verification of the Lunar Theory."

V. M. Slipher,* Director, Lowell Observatory. "Trans-Neptunian Planet Search."

Earl C. Slipher, Lowell Observatory. (Introduced by John A. Miller.) "The Planets from Observations at the Lowell Observatory." (Read by Dr. V. M. Slipher.)

Harlow Shapley, Director, Harvard College Observatory. "A Survey of Two Metagalactic Clouds."

Karl K. Darrow, Physicist, Bell Telephone Laboratories. "Neutral Particles in Physics." (Discussed by Drs. Swann and Humphreys.)

Arthur J. Dempster, Professor of Physics, University of Chicago. "The Isotopic Constitution of the Rarer Earth Elements."

* Recipient of Grant from the Penrose Fund.

Herbert Fox, Professor of Comparative Pathology, University of Pennsylvania, and Pathologist to the Philadelphia Zoological Society. "Chronic Arthritis in Wild Mammals, Its Spontaneous Occurrence and Its Relation to Man's Ailment."

William B. Scott,* Blair Professor Emeritus of Geology, Princeton University. "Report of Progress, Monograph of White River Mammalia, Part IV, the Artiodactyla."

Aleš Hrdlička, Curator, Division of Physical Anthropology, United States National Museum. "Further Evidences of a Normal Growth of the Head During Adult Life in Intellectually Active Individuals."

William Trelease, Professor Emeritus of Botany, University of Illinois. "Pothomorphe, Heckeria, Lepianthes." (Read by title.)

William H. Brown, Department of Botany, Johns Hopkins University. (Introduced by Edward W. Berry.) "The Bearing of Nectaries on the Phylogeny of Flowering Plants."

Thursday, April 21, 2 P.M.

ROBERT A. MILLIKAN, Vice-president, in the Chair

Detlev W. Bronk and Adolph H. Schultz, recently elected members, subscribed the Laws and were admitted into the Society.

The following papers were read by the persons named:

Ralph E. Cleland,* Professor of Biology, Goucher College. "Further Progress in the Analysis of Segmental Arrangements of Chromosomes in *Onagra*."

Anna R. Whiting,* Guest Investigator, Department of Zoology, University of Pennsylvania. (Introduced by Dr. J. P. Moore.) "Mutant Body Colors in the Parasitic Wasp, *Habrobracon*."

Elsie Lincoln, Zoological Laboratory, University of Pennsylvania. (Introduced by Dr. Calvert.) "Rhythm in Growth of Insects."

Gerhard Fankhauser, Assistant Professor of Biology, Princeton University. (Introduced by Dr. Conklin.) "Polyploidy in Vertebrates."

Edwin G. Conklin, Professor Emeritus of Biology, Princeton University. "Disorientations of Development by Means of Low Temperatures."

Charles R. Stockard, Professor of Anatomy, Cornell University. "Relations of Genetic and Endocrine Factors in Instinctive and Reflex Behavior."

Alexis Carrel, Head, Division of Experimental Surgery, Rockefeller Institute for Medical Research. "Culture of Whole Organs in the Lindbergh Apparatus."

E. Newton Harvey. Professor of Physiology, Princeton University. Alfred L. Loomis, and Garret Hobart. "Localization of Electric Potentials over the Human Brain." Davenport Hooker. Professor of Anatomy, University of Pittsburgh School of Medicine. (Introduced by Dr. Coghill.) "The Origin of the Grasping Movement."

Friday, April 22, 10 A.M.

EXECUTIVE SESSION

ROLAND S. MORRIS, President, in the Chair

The President submitted his annual report.

The Treasurer's report was submitted together with the Auditor's report.¹

President Morris reported that Council had considered the advisability of making some necessary repairs in the Society's building during the coming summer. The Society unanimously approved Council's recommendation that the Committee on Building Fund be authorized to expend such moneys as, in their judgment, would be advisable for the purpose of installing a new heating system and remodeling the basement.

Dr. Sioussat, Chairman of the Committee on Library, presented his report and stated that a complete account of the Library's accessions, exhibitions and activities during the year 1937 would be found in the printed report included in the YEAR BOOK.²

Dr. Conklin presented a report on behalf of the Committee on Publications.³

Dr. Conklin, Chairman of the Committee on Research, gave an account of the work of the Committee during the year and stated that a complete account of the Committee's activities together with reports of recipients of grants would be found in the printed report in the YEAR BOOK.⁴

A letter was read from G. W. Hunter, Chairman, Board of Trustees for *Biological Abstracts*, requesting a grant for the continuation of *Biological Abstracts*. The following resolution recommended by Council, was approved:

Resolved, That the Committee on Research be authorized to make a grant not to exceed \$5,000 for the continuation of *Biological Abstracts*.

¹ YEAR BOOK, Amer. Philos. Soc., 1937: 245-268.

² Ibid., 69-106.

³ Ibid., 107-112.

⁴ Ibid., 113-244.

President Morris reported on the old Custom House as a possible Library building and stated that Council had recommended that reports should be obtained from an architect and an engineer on the condition of this building and that the Committee on Finance be authorized to approve \$2,000 for this purpose. He further stated that Council had recommended that these reports be referred to the Committees on Library and Finance for their approval or disapproval and reported back to Council for final action. After some discussion it was moved and seconded that Council's recommendation be amended and that the Committee on Finance be authorized to expend not more than \$5,000 for the reports of the architect and engineer on the condition of the old Custom House and the possibilities of using it for the Society's Library in the future.

The following committee was appointed in accordance with the request of Dr. Frederick P. Keppel, of the Carnegie Corporation of New York, to supervise an investigation on methods and results of adult education in science:

Anton J. Carlson	Harlow Shapley
Edwin G. Conklin	George G. Simpson
Karl K. Darrow	W. F. G. Swann
Luther P. Eisenhart	Rodney H. True
C. E. Kenneth Mees	Harold C. Urey
Roland S. Morris, ex-officio	

The following Committee on Finance was unanimously elected for the year 1938-39:

William P. Gest, Chairman	Roland S. Morris
Thomas S. Gates	George W. Norris
John S. Jenks	Charles J. Rhoads
Marshall S. Morgan	J. Henry Scattergood

The Committee on Finance was appointed to serve as the Society's Committee on Building Fund.

JOHN F. LEWIS PRIZE

The Council's recommendation was approved that the John F. Lewis Prize be awarded to Arthur J. Dempster, of the University of Chicago, for his work on

"New Methods in Mass Spectroscopy." (Read in part April 20, 1935. PROC. AMER. PHILOS. SOC., 75: 755-767.)

"Further Experiments on the Mass Analysis of the Chemical Elements." (Read April 25, 1936. PROC. AMER. PHILOS. SOC., 76: 491-496.)

The establishment of a Pension Fund for the employees of the Society was unanimously approved and the matter was referred with power to the Committee on Finance.

The names of members¹ who had died since the last meeting were read by the Secretary.

AMENDMENTS TO LAWS

Amendments to Articles 1 and 2 of Chapter I of The Laws, were considered and ordered to be sent to each member of the Society in advance of the November meeting, at which time they would be voted upon.

The amendments to the Laws proposed at the February meeting were considered and on motion, duly seconded, approved as follows:

CHAPTER I, ARTICLE 5 reads: "It shall be the duty of the Committee on Membership of each class to prepare an 'eligible list' of not more than twenty-five persons who are judged most worthy of resident membership in that class; and a list of not more than six who are judged most worthy of foreign membership in the class. This list shall be revised from year to year."

Entire article was omitted and the following was substituted:

ARTICLE 5. "Nominations to membership shall be made in writing by the Committees on Membership, or they may be made by any five members of the Society and addressed to the Secretaries before November first in each year. Nominations shall be on blank forms provided for that purpose and shall specify the qualifications and principal activities or fields of learning of the nominees. In case of non-election nominations may be continued by the written endorsement of three of the proposers filed with the Secretaries before November first following; these nominations may be continued a second time in similar manner, after which the names of the unsuccessful candidates will be dropped and all papers relating thereto destroyed. Such candidates may be considered again only by entirely new nominations."

CHAPTER I, ARTICLE 6 reads: "Before December first in each year the Chairman of each Committee on Membership shall submit this *eligible list* to all members of his class, together with all *continued nominations* within that class which are carried over from

¹ See p. 354.

the previous year by request of three or more members. Blank spaces shall be provided for the addition of *new nominations*. Members of the class shall be requested to use these lists as a *preliminary ballot*, to check or write on them the names of those persons whom they wish to propose for membership, and to sign and return this ballot to the Secretaries before January first."

Amended to read:

ARTICLE 6. "Before December first in each year the Chairman of each Committee on Membership shall submit to the members of his class a list of all the nominations in the class and shall request them to use this list as a *preliminary ballot* and to check on it the names of those persons, not more than twelve in number, whom they prefer for resident members, and not more than five whom they prefer for foreign members, and to sign and return this ballot to the Secretaries before January first."

CHAPTER I, ARTICLE 7 reads: "Before February first each Committee on Membership shall select from this *preliminary ballot* the names of those persons, not more than ten in number in each class, who have received the highest number of votes for resident membership, and the names of those persons, not more than three in number in each class, who have received the highest number of votes for foreign membership."

Amended to read:

ARTICLE 7. "Before February first each Committee on Membership shall select from among those nominees having a high number of votes in the *preliminary ballot* not more than twelve for resident membership and not more than five for foreign membership in each class, due regard being given to a proper representation of the various subjects within the class."

CHAPTER I, ARTICLE 11 reads: "The members are mutually pledged not to mention out of the Society any recommendations, nominations, or proposals for membership and all papers relating thereto shall be destroyed within three months from the date of the election to membership, except those papers which relate to recommendations, nominations, or proposals that are continued in accordance with the regulations prescribed in Art. 6 of this Chapter."

Amended to read:

ARTICLE 11. "The members are mutually pledged not to mention to non-members of the Society the name of any nominee proposed, or of any withdrawn or unsuccessful nominee."

CHAPTER VI, ARTICLE 1 reads: "The Stated Meetings of the Society shall be on the first Friday of every month from November to March, save as the President and Council may from time to time determine."

Omitted entirely.

CHAPTER VI, ARTICLE 2 reads: "A General Meeting shall be held in the month of April on days designated by vote of the Council, adopted at least three months before the date fixed therefor, at which it shall be lawful to transact all business which might be transacted at any Stated Meeting."

Amended to read:

ARTICLE 1. "The Annual General Meeting shall be held in the month of April on days designated by vote of the Council, adopted at least three months before the date fixed therefor, at which it shall be lawful to transact all business not in contravention of the Laws."

New article inserted:

CHAPTER VI, ARTICLE 2. "The Autumn General Meeting shall be held on days designated by vote of the Council, usually in the month of November, at which it shall be lawful to transact all business not in contravention of the Laws."

CHAPTER VII, ARTICLE 1 reads: "The publications of the Society shall consist of PROCEEDINGS, TRANSACTIONS, MEMOIRS, and of such other serial or separate publications as may be authorized by the Council upon recommendation by the Committee on Publications."

Add:

"YEAR BOOK" after "MEMOIRS" in second line.

CHAPTER VII, ARTICLE 2 reads: "The PROCEEDINGS shall contain the proceedings, acts, and reports of the Society, the Council, the Committees, and the Officers. They shall also contain those papers read before the Society at its meetings that may be selected by the Committee on Publications from among the papers transmitted to it by the Committee on Meetings. The PROCEEDINGS shall be distributed without charge, as issued, to all members who express a desire to receive them."

Amended to read:

ARTICLE 2. "The PROCEEDINGS shall contain papers that are read before the Society at its meetings and that have been approved by the Committee on Publications. Other papers from whatever source may also be published in the PROCEEDINGS if approved by this Committee. The PROCEEDINGS will be distributed without charge, as issued, to the members who request it."

New article inserted:

CHAPTER VII, ARTICLE 5: "The YEAR BOOK shall contain, among other items, the Charter and Laws, list of Officers and Committees, the annual report of the President and Officers, important acts of the Society and Council, reports of all standing Committees, a catalogue of prizes, premiums and lectureships, lists of all members together with those elected and those deceased during the year, and obituaries of deceased members. It shall be published as soon as possible after the close of each calendar year and shall be sent gratis to all members of the Society."

ANNUAL ELECTION

The Society proceeded to the election of officers and members. Charles G. Abbot and Ernest M. Patterson acted as Judges and Waldo G. Leland as Clerk of election.

The tellers subsequently reported that the following officers and members had been duly elected:

President

Roland S. Morris

Vice-presidents

Edwin G. Conklin

Robert A. Millikan

Cyrus Adler

Secretaries

John A. Miller

William E. Lingelbach

Curator

Albert P. Brubaker

Treasurer

Fidelity-Philadelphia Trust Company

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Councillors

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Members

CLASS I—MATHEMATICAL AND PHYSICAL SCIENCES

Resident

Carl David Anderson, Pasadena, Calif.

William David Coolidge, Schenectady, N. Y.

Frederick Gardner Cottrell, Washington, D. C.

Frank Baldwin Jewett, Brantwood, N. J.

Frederick George Keyes, Cambridge, Mass.

John von Neumann, Princeton, N. J.

Foreign

Paul Adrien Maurice Dirac, Cambridge, England.

CLASS II—GEOLOGICAL AND BIOLOGICAL SCIENCES

Resident

Karl Spencer Lashley, Cambridge, Mass.

John Howard Northrop, Princeton, N. J.

Francis Bertody Sumner, La Jolla, Calif.

David Hilt Tennent, Bryn Mawr, Pa.

Donald Dexter Van Slyke, New York, N. Y.

George Hoyt Whipple, Rochester, N. Y.

Foreign

Edgar Douglas Adrian, Cambridge, England.

Archibald Vivian Hill, London, England.

CLASS III—SOCIAL SCIENCES

Resident

James Truslow Adams, New York, N. Y.
Nicholas Murray Butler, New York, N. Y.
Edward Hopkinson, Jr., Philadelphia, Pa.
Charles Howard McIlwain, Belmont, Mass.
Harold Glenn Moulton, Washington, D. C.
Oliver Mitchell Wentworth Sprague, Boston, Mass.
Joseph Henry Willits, Philadelphia, Pa.

Foreign

Charles Rist, Versailles, France.
Harold William Vazeille Temperley, Cambridge, England.

CLASS IV—HUMANITIES

Resident

Campbell Bonner, Ann Arbor, Mich.
C. F. Tucker Brooke, New Haven, Conn.
Frederick Paul Keppel, Montrose, N. Y.
Henry Carrington Lancaster, Baltimore, Md.
Benjamin Dean Meritt, Princeton, N. J.
Charles Rufus Morey, Princeton, N. J.

Friday, April 22, 2 P.M.

EDWIN G. CONKLIN, Vice-president, in the Chair

George Henry Chase, Vannevar Bush, Edwin Francis Gay, Hu Shih and Conyers Read, recently elected members, subscribed the Laws and were admitted into the Society.

The following papers were read by the persons named:

- Albert T. Volwiler,* Professor of History, Ohio University.
(Introduced by Dr. Lingelbach.) "Benjamin Harrison,
James G. Blaine, and American Diplomacy, 1889-1893."
Edward S. Corwin, McCormick Professor of Jurisprudence,
Princeton University. "The Relations of Secretary
Stanton and President Johnson."
William E. Lingelbach,* Professor of Modern European His-
tory, University of Pennsylvania. "Neutrality vs. Al-
liances: Belgium, 1936-."
Edwin Francis Gay, Professor Emeritus of Economic His-
tory, Harvard University. "A History of Crises."

- S. W. Boggs, Geographer, United States Department of State. (Introduced by Drs. Bowman and Leland.) "The Map of Latin America by Treaty."
- William H. Hobbs, Professor Emeritus of Geology, University of Michigan. "The Early Discoveries of Antarctica as Revealed by Newly Found Maps and Documents."
- John C. Merriam, President, Carnegie Institution of Washington. "Historical Research and Preservation of Historical Remains at St. Augustine."
- Robert R. McMath, Director, McMath-Hulbert Observatory, University of Michigan. (Introduced by Dr. Curtis.) "Recent Studies of Solar Surface Phenomena."

Friday, April 22, 8:15 P.M.

THE R. A. F. PENROSE, JR., MEMORIAL LECTURE

Samuel A. Mitchell, Director, Leander McCormick Observatory, University of Virginia. Subject: "With an Astronomer on an Eclipse Expedition."

The lecture was followed by a reception.

Saturday, April 23, 10 A.M.

ROLAND S. MORRIS, President, in the Chair

Herbert Spencer Gasser and John S. P. Tatlock, recently elected members, subscribed the Laws and were admitted into the Society. The following papers were read by the persons named:

- William Albert Noyes, Professor Emeritus of Chemistry, University of Illinois. "A New Holism."
- John R. Murlin, Professor of Physiology, University of Rochester, and A. Black. "Total Energy Metabolism of Rats at Various Ages as Affected by Protein and Exercise." (Read by title.)
- D. Sutherland Davidson,* Assistant Professor of Anthropology, University of Pennsylvania. (Introduced by Dr. Jayne.) "An Ethnic Map of Australia." (Discussed by President Morris. Drs. Davenport, MacCurdy and Parker.)
- Thomas T. Waterman, Architect, United States Government. (Introduced by Dr. Holland.) "English Antecedents of Virginia Architecture." (Discussed by Professor Wertenbaker, a guest.)
- George H. Chase, Professor of Classical Archaeology, Harvard University. "The *Corpus Vasorum Antiquorum* and the Documentary Value of Ancient Vases."

William Bell Dinsmoor, Professor of Archaeology, Columbia University. "Archaeology and Astronomy."

Franklin Edgerton, Professor of Sanskrit and Comparative Philology, Yale University. "Etymology and Interpretation."

Gilbert Chinard, Professor of French Literature, Princeton University. "Polybius and the American Constitution."

J. S. P. Tatlock, Professor of English, University of California. "Geoffrey of Monmouth's Motive for Writing his *Historia*."

Immediately after luncheon members and guests were taken on an expedition through the Wissahickon Valley to the Morris Arboretum of the University of Pennsylvania and then to the home of Mr. John Story Jenks at Chestnut Hill where they were entertained.

Saturday, April 23, 7:30 P.M.

The annual dinner was held at the Bellevue-Stratford Hotel, President Morris presiding.

After dinner. Vice-president Millikan presented Arthur J. Dempster of the University of Chicago for the John F. Lewis Prize for his work entitled:

"New Methods in Mass Spectroscopy." (Read in part April 20, 1935. PROC. AMER. PHILOS. SOC., 75: 755-767.)

"Further Experiments on the Mass Analysis of the Chemical Elements." (Read April 25, 1936. PROC. AMER. PHILOS. SOC., 76: 491-496.)

The prize was then awarded and a check for three hundred dollars and a diploma were presented to Dr. Dempster who made a gracious response in accepting this honor.

The following after dinner addresses were made:

George H. Parker, Professor Emeritus of Zoology, Harvard University. "The Early Life of Benjamin Franklin in Boston."

Hu Shih, Dean, Peiping National University. "International Relations."

John S. P. Tatlock, Professor of English, University of California. "The Unity of Education."

AMERICAN PHILOSOPHICAL SOCIETY

AUTUMN GENERAL MEETING

November 18, 19, 1938

Friday, November 18, 10:30 A M.

ROLAND S. MORRIS, President, made the welcoming address.

The following Symposium,¹ arranged by the Population Association of America, was presented:

“INTRINSIC AND ENVIRONMENTAL FACTORS IN AMERICAN
POPULATION GROWTH”

LOWELL J. REED, Dean, School of Hygiene and Public Health,
Johns Hopkins University, in the Chair

Conrad Taeuber, Agricultural Economist, United States Department of Agriculture. “Agriculture and Current Population Trends.”

Warren S. Thompson, Director, Scripps Foundation for Research in Population Problems, Miami University. “The Social Environment as a Factor in Population Growth.” (Discussed by Drs. J. McK. Cattell and R. L. Dickinson.)

Frank W. Notestein, Lecturer, School of Public Affairs, Princeton University. “Intrinsic Factors in Population Growth.”

John C. Flanagan, Assistant Director, Cooperative Test Service of the American Council on Education; Instructor, Teachers College, Columbia University. “A Study of Psychological Factors in Relation to Fertility.” (Discussed by Drs. Frederick Osborn and Raymond Pearl.)

Clyde V. Kiser, Member of Technical Staff, Milbank Memorial Fund. “Voluntary and Involuntary Aspects of Childlessness (An Analysis of Data Collected from a Surveyed Group of White Couples in New York City).”

Mortimer Spiegelman, Member of Staff, Statistical Bureau, Metropolitan Life Insurance Company. “Mortality in Relation to Widowhood.”

Friday, November 18, 2 P.M.

ROLAND S. MORRIS, President, in the Chair

Frederick P. Keppel and Samuel Eliot Morison, recently elected members, subscribed the Laws and were admitted into the Society.

A Round Table Conference on the topic, “*Quo Vadis: An Appraisal of Population Prospects*,” arranged by the Population Association of America was presented as follows:

¹ PROC. AMER. PHILOS. SOC. 80: 477-626.

WALTER F. WILLCOX, Professor Emeritus of Economics and Statistics, Cornell University, in the Chair

The following persons led the discussion:

Waldemar B. Kaempffert, Science Editor, *The New York Times*. "Technological Advance in Relation to Population Trends."

Carl Cleveland Taylor, In Charge, Division of Farm Population and Rural Life, United States Department of Agriculture. "Prospective Development of Cultural Patterns in Rural America and Their Possible Influence on Population Trends."

Harry L. Shapiro, Associate Curator of Physical Anthropology, American Museum of Natural History. "Anthropological Aspects."

Friday, November 18, 6:45 P.M.

A dinner for the out-of-town members and guests was held at the Benjamin Franklin Hotel. Dr. Raymond Pearl, Professor of Biology, Johns Hopkins School of Hygiene and School of Medicine, made a brief address expressing his gratification that Benjamin Franklin's old Society had sponsored this Symposium by one of the youngest societies of America.

Friday, November 18, 8:15 P.M.

Public Lecture by Alfred J. Lotka, President of the Population Association of America and Assistant Statistician, Metropolitan Life Insurance Company; Subject: "Contacts of Population Study with Related Branches of Science."

Saturday, November 19, 9 A.M.

EXECUTIVE SESSION

ROLAND S. MORRIS, President, in the Chair

Alfred Newton Richards and H. Carrington Lancaster, recently elected members, subscribed the Laws and were admitted into the Society.

The recommendation of the Committee on Finance and of the Council concerning the sale of the Daland property located at 317 South 18th Street was favorably considered and the following resolution was unanimously approved:

Resolved, That the American Philosophical Society hereby approves the actions of the Committee on Finance in selling the property, located at 317 South 18th Street, Philadelphia, to Dr. August Cordes, or his nominees, for the sum of \$8,000 part in cash and part in the form of a mortgage for \$6,500. *Be It Further Resolved*, That the Officers of the American Philosophical Society and the Committee on Finance are hereby authorized to complete such sale and to do all that is necessary to pass good title to the property.

Mr. Morgan's report concerning the activities of the Committee on Finance and of the Treasurer was unanimously approved. The budget for 1939 was presented by Mr. Morgan and the Minutes of the meetings of the Committee on Finance held since the last Council meeting were on motion approved. The reports and minutes were ordered to be filed.

Dr. Conklin reported that in accordance with the Society's recommendation a gas heating system had been installed and that the store room in the basement had been converted into two offices or meeting rooms.

The Council's recommendation that due notice be given that the contract between the American Philosophical Society and the University of Pennsylvania Press be severed on June 30, 1939, was unanimously approved.

The names of members¹ who had died since the last meeting were read.

AMENDMENTS TO THE LAWS

The amendments to the Laws proposed at the General Meeting in April were on motion, duly seconded, approved as follows:

CHAPTER I, ARTICLE 1 reads: "The resident members of the Society are elected from among citizens or residents of the United States who have achieved distinction in the sciences or humanities, in letters, in the practice of the arts or of the learned professions, or in the administration of affairs. Their number may not exceed five hundred, nor may more than twenty-five be elected in any one year."

Insert "thirty" in place of "twenty-five" in the last sentence.

CHAPTER I, ARTICLE 2 reads: "The foreign members of the Society are elected from among persons who are neither citizens nor residents of the United States, and who are of the greatest eminence for their attainments in science, letters, or the liberal arts. Their

¹ See p. 354.

number may not exceed sixty, nor may more than five be elected in any one year."

Insert: "eight" in place of "five" in the last sentence.

Dr. Chevalier Jackson offered his resignation as a member of the Society; on motion it was duly accepted.

Saturday, November 19, 9:30 A.M.

EDWIN G. CONKLIN, Vice-president, in the Chair

The following papers were read by the persons named:

Karl K. Darrow, Research Physicist, Bell Telephone Laboratories. "The Heavy Electron." (Discussed by Dr. Franck.)

Allan C. G. Mitchell,* Professor of Physics, Indiana University. (Introduced by Dr. S. A. Mitchell.) "The Radioactivity of Indium Produced by Slow Neutrons." (Discussed by Dr. Franck.)

Ralph A. Beebe,* Professor of Chemistry, Amherst College. "Adsorption Calorimetry and an Account of Some Measurements at Low Temperatures." (Discussed by Drs. Darrow, Franck and a guest.)

Alexander Goetz,* Associate Professor of Physics, California Institute of Technology. (Introduced by Dr. Millikan.) "The Living State of Matter in the Range of Low Temperatures." (Discussed by Drs. Davenport, Conklin and two guests.)

Laurence Irving,* Director, Edward Martin Biological Laboratory, Swarthmore College. "Vascular Adjustments of Diving Animals During Apnea." (Discussed by Dr. Conklin.)

Laurence Irving,* Director, Edward Martin Biological Laboratory, Swarthmore College, F. E. J. Fry and E. C. Black, University of Toronto. "The Effect of CO₂ in Water upon Respiration of Fish. (Read by title.)

Francis Harper,* Research Associate, American Committee for International Wild Life Protection. "Factors in the Progressive Decline of the World's Mammalian Faunas." (Discussed by President Morris, Drs. W. B. Scott, Jones, Darrow and Merrill.)

P. W. Whiting,* Associate Professor of Zoology, University of Pennsylvania. "Sex-determination and Reproductive Economy in the Wasp *Habrobracon*."

T. M. Sonneborn,* Associate in Zoology, Johns Hopkins University. "Mating Types, Toxic Interactions and Heredity in *Paramecium aurelia*."

Albert G. Rau,* Dean, Moravian College and Theological Seminary. "Musical Compositions by American Moravians from 1742 to 1842." (Discussed by President Morris.)

Saturday, November 19, 2 P.M.

ROLAND S. MORRIS, President, in the Chair

The following papers were read by the persons named :

E. D. Merrill,* Professor of Botany, Administrator of Botanical Collections, Harvard University. "The Bornean Species of the Myrtaceous Genus *Syzygium*, Gaertner."

William B. Scott,* Professor Emeritus of Geology, Princeton University. "White River Artiodactyla."

Linton Satterthwaite, Jr.,* Assistant Curator, American Section, University Museum, University of Pennsylvania. (Introduced by Dr. Jayne.) "Evidence for a Logical Sequence of Roof Types on Maya Buildings at Piedras Negras."

Millar Burrows,* President, American Schools of Oriental Research; Professor of Biblical Theology, Yale University. (Introduced by Dr. Albright.) "The Excavation of Tell el-Kheleifeh (Ezion-geber) by the American Schools of Oriental Research."

Nabih Amin Faris,* Research Associate in Oriental Languages, Princeton University. "The *Ihyā'* 'Ulūm al-Dīn of al-Ghazzālī."

V

REPORTS OF COMMITTEES

1. REPORT OF THE COMMITTEE ON MEETINGS

The Committee consists of the following members: Edwin G. Conklin, *Chairman*, Cyrus Adler, Ralph E. Cleland, Karl K. Darrow, Merkel H. Jacobs, Waldo G. Leland, William E. Lingelbach, John A. Miller, Jesse S. Reeves, Harlow Shapley, Hugh S. Taylor and Roland S. Morris, *President*. During the year the Committee met on February 4, March 23, May 18, October 19 and December 21 and arranged for the following programs:

On February 18 and 19 a Joint Meeting of this Society with representatives of fifty-three organizations and institutions concerned with the publication of research was held in the Hall of the Society. Approximately one hundred persons were present, those from out of town being guests of the Society. The first day of the meeting was given to round table conferences on the cost of publications. Jacob R. Schramm, Professor of Botany, University of Pennsylvania, and Robert C. Binkley, Chairman, Joint Committee on Materials for Research of the American Council of Learned Societies and the Social Science Research Council, opened the discussion. In the evening there were two lectures, one by Dumas Malone, Director, Harvard University Press, on "The Scholar and the Public"¹ and the other by Donald P. Bean, Director, University of Chicago Press, on "The Riddle in Research."²

A reception was held immediately after the lectures. On Saturday, February 19, a general discussion of the publication program of the American Philosophical Society and proposals for its improvement was led by the following members representing the four classes of members: W. F. G. Swann, H. S. Taylor, H. N. Russell, E. G. Conklin, A. F. Blakeslee, E. S. Corwin, W. E. Lingelbach, C. Read, E. M. Patterson and W. G. Leland. The principal addresses in this discussion are published in the Report of the Committee on Publications.³

¹ PROC. AMER. PHILOS. SOC. 80: 25-36.

² Ibid. 37-47.

³ See p. 83.

On March 15, the Henry La Barre Jayne Memorial Lecture was given in the Hall of the Society by Karl T. Compton, President of the Massachusetts Institute of Technology, on the subject "The Social Implications of Scientific Discovery." About two hundred persons were present and the lecture was followed by a reception. This lecture was published by the Trustees of the Jayne Memorial Lecture Foundation as one of the series of the Jayne Lectures, and is available on application to this Society.

The Annual General Meeting of 1938 was held on April 21, 22 and 23 with one hundred and twenty-seven members and about one hundred guests in attendance. Thirty-six papers were read and the R. A. F. Penrose, Jr., Memorial Lecture was given by Dr. S. A. Mitchell, Director, Leander McCormick Observatory, University of Virginia, on the subject: "With An Astronomer on an Eclipse Expedition."¹ The address was followed by a reception in the Hall of the Society. The annual Executive Session of the Society was held on Friday morning, April 22. The annual dinner at the Bellevue-Stratford Hotel on Saturday evening, April 23, was attended by one hundred and ninety-five guests. After dinner Vice-president Millikan presented Arthur J. Dempster of the University of Chicago for the John F. Lewis Prize.² Dinner addresses were given by George H. Parker, Professor Emeritus of Zoology, Harvard University; Hu Shih, Dean, Peiping National University and John S. P. Tatlock, Professor of English, University of California.

On June 10 in the Hall of the Society the Award of the John Scott Medal and honorarium by the Board of Directors of City Trusts of Philadelphia was made to

Dr. Wendell M. Stanley, Rockefeller Institute for Medical Research—for the isolation of the Tobacco Mosaic Virus in Crystalline Form.

Mr. Edwin H. Land, Boston—for the invention of a substance designated "Polaroid."

The third Autumn General Meeting was held on November 18 and 19. Fifty-seven members and about one hundred guests were present. On Friday, November 18, a Symposium on "Intrinsic and Environmental Factors in American Population Growth"³ which was arranged by the Population Association of America

¹ PROC. AMER. PHILOS. SOC., 79: 341-360.

² See p. 39.

³ PROC. AMER. PHILOS. SOC. 80: 477-626.

was presented. Six papers were presented in this symposium which was followed by a round table conference. The Friday evening lecture was given by Alfred J. Lotka, President of the Population Association of America; Assistant Statistician, Metropolitan Life Insurance Company, on "Contacts of Population Study with Related Branches of Science." This lecture was followed by a reception in the Hall of the Society. On Saturday, November 19, fifteen papers were read. All of these except one were by recipients of grants from the Penrose Fund of the American Philosophical Society, and several of them were of outstanding interest and elicited much discussion. Some of them are in the course of publication.

The plan of concentrating the meetings of the Society in two General Meetings and occasional special meetings is working very well and should be continued.

2. REPORT OF THE COMMITTEE ON HALL

The Committee on Hall consists of the following members: J. Bertram Lippincott, *Chairman*, Paul P. Cret, Lawrence J. Morris, J. Rodman Paul, John M. Scott, Roland S. Morris, *President*, and Albert P. Brubaker, *Curator*; Edwin G. Conklin, *Executive Officer* sits with the Committee. The members of this Committee are busy men of affairs and professions and they are not called to meet together except on important business. Consequently, few formal meetings are held and minor matters are handled by the President and the Chairman of the Committee, on information supplied by the Executive Officer. The Council recommended to the Society and at its meeting in April 1938 the Society voted to charge repairs and alterations of the Hall to the relatively large Building Fund rather than to the small, special appropriation to the Committee on Hall. Accordingly, the cost of the alterations listed below were submitted to the Committee on Building Fund for approval. This Committee is composed of the same members as the Committee on Finance and it has approved all the repairs and alterations here mentioned.

1. Installation in the sub-basement of gas heating steam boiler for the Society's room and a second smaller boiler for the janitor's quarters. The old boiler sprang a leak during the Autumn Meeting of 1937 and caused much anxiety but it was patched up temporarily and was made to last until the summer. In the meantime, an extensive investigation was made as to the best form of fuel. The continued use of coal, with the dust and ashes involved, was objectionable and an oil heating system was carefully considered. However, the difficulty of providing storage space for oil, since tanks could not be placed in Independence Square or even under the sidewalk on Fifth Street, caused us to abandon the plan of oil fuel. An investigation of the use of gas finally led to the adoption of this system which is perfect so far as its efficiency is concerned but it must be admitted that it is more expensive than the other fuels mentioned. The installation of this new heating system has made possible the cleaning up of the sub-basement so that it is now in very excellent condition.

2. Removal of old wooden shelves in third floor library room

and substitution of the metal shelving from the balcony in that room. This has greatly improved the appearance and convenience of this storage space which is now almost fully occupied with back numbers of the publications of the Society which have been transferred from a dark and crowded room in the basement. These back publications are now arranged serially and they have been inventoried so that we have a record of the number of copies of each issue.

3. The basement room which was thus emptied was in very bad condition requiring replastering, painting, floor covering, wiring, lighting and the installation of telephones; it was partitioned into two rooms, one of which is equipped for the use of the representatives of the press and for our own publicity and publication work and the other room which is large and well lighted makes an excellent committee room. These are very desirable additions to the facilities of the Hall.

4. The iron steps from the first floor hall into Independence Square were repaired at a small expense. This was necessary in order to prevent possible accidents; they were in a ruinous condition.

5. Two exhibition cases were purchased for use in the Members' Room on the second floor and two for use in the Library in the Drexel Building. The exhibits are changed from time to time and an attempt is made to have some of the most interesting treasures of the Society exhibited during the various meetings. Owing to the very crowded condition of the safe in the Library, two wall cases provided with wire glass doors and strong locks were installed and into these some of the books which were crowded into the safe have been placed. Additional shelves and a wire gate for the vault front in the Library were also purchased as well as venetian blinds and curtains for the Librarian's office.

6. The Society was fortunate in being able to purchase a penciled sketch of Benjamin Franklin by Benjamin West. This beautiful sketch bears on its reverse side the signature of Benjamin West and an account of its previous owners, the latest being a former member of this Society, the Honorable Samuel W. Pennypacker, who bought the sketch in London in 1898 and had it framed in a part of the original flooring of Independence Hall which was removed at the restoration of that building in 1898.

A portrait of James Wilson, one of the important framers of

the Constitution of the United States and a former honored member of the Society, was purchased from the artist, Mr. H. B. McIntyre. It has been beautifully framed and is now hanging in the visitors' waiting room.

7. An additional desk for the secretaries' office was purchased and a number of tables have been made from lumber which was saved in the removal of the wooden shelves in the third floor.

The total cost of these items was \$7,715.65 and it was paid from the Building Fund.

The Society loaned the following items to the Franklin Institute on the occasion of the dedication of its new building:

1. Dolland refracting telescope used by David Rittenhouse in the observation of the transit of Venus across the disk of the Sun in 1769.
2. Transit instrument made and used by David Rittenhouse on that occasion.
3. Portrait of David Rittenhouse by Charles Willson Peale.
4. Model of John Fitch's steamboat.

During the Tercentenary celebration of the founding of the Swedish Colony on the Delaware the Society loaned to Old Swedes Church, *Gloria Dei*, the Horologium Achaz. All these articles were returned in good condition.

3. REPORT OF THE COMMITTEE ON THE LIBRARY

The Committee on the Library has the honor to present the following report for the calendar year 1938. The first part of the report has been prepared by the Librarian.

I. REPORT OF THE LIBRARIAN

Additional Equipment Acquired.

On March 1, 1938, the Society renewed for a term of five years the lease on its present quarters in the Drexel Building and also took a lease for the same time on 1,500 square feet of additional space adjoining the Reading Room on the second floor. In this space stacks have been erected to accommodate approximately 10,000 books. In this extension provision is made for a room for the Committee's meetings and one for the Librarian's office. About 5,000 volumes have been transferred from the old Library to the new quarters in the Drexel Building. This has necessitated the shifting of nearly all of the books in the Library. Two metal book-cases equipped with locks and wire-glass doors have been installed in the Committee's Meeting Room. These cases will accommodate 2,000 books and will be used to house the rare books from the overcrowded fireproof vault, and the valuable books now on the open shelves for which there was no room in the vault. A full length wire gate with lock has been placed on the fireproof vault containing the manuscripts. Heavy duck curtains have been hung on the east windows of the stacks to shield the books from the bright sunlight. Four exhibition cases have been procured, two of which are placed in the Members' Room in the Hall of the Society and two in the Reading Room of the Library in the Drexel Building. A fifteen-drawer card cabinet also has been added.

Holdings of the Library.

At the close of 1938 the total number of volumes in the Library is 82,369, of pamphlets 49,834, of maps 5,557. At the close of 1937 the corresponding figures were: books 81,657, pamphlets 49,051, maps 5,457.

Additions to the Library.

Exclusive of serials there have been added to the Library, 712 volumes, 777 pamphlets, 100 maps, 79 manuscripts, 2,505 photostats, 32 engravings, and 2 broadsides. Of these there have been acquired by gift, 96 volumes, 502 pamphlets, 4 photostats, 1 manuscript, 98 maps, 1 broadside; by purchase, 616 volumes, 275 pamphlets, 2,501 photostats, 78 manuscripts, 2 maps, 32 engravings, and 1 broadside.

The purchases have been on account of the following :

Funds	Purpose	Vol.	Pam.	Photo- stats	Maps	Mss.	Eng.	Serials
General	Unrestricted	381	174	2270	2	75		91
Balch	Intern. Law							3
Boyé	Chemistry and Geology							3
Carlier	Unrestricted	26						9
Franklin	Unrestricted	4	10	231		1	32	3
Jefferson	Unrestricted					1		2
Magellanic	Navigation, Astronomy, Natural Philosophy							7
Michaux	Forestry, Botany, Agri- culture	49	54			1		58
Norris	Unrestricted	12						2
Phillips	Archaeology, Philology	139	37					126
Proud	Unrestricted	5						5
Seybert	Unrestricted							3
Tilghman	Unrestricted							3

In addition to the above there was acquired, on exchange account, from the Library of Congress, a map inscribed, "To the American Philosophical Society, This Map of the Peninsula Between Delaware & Chesopeak Bays . . . by John Churchman [1786]."

Donations to the Library.

At a recent General Meeting of the Society the President voiced a plea to the members asking that they present copies of their publications to the Library. Several of the members have responded to Mr. Morris's suggestion by presenting books and serials from their libraries, which have helped to complete broken files, as well as their own writings. The Committee on the Library extends its thanks to the following members for their generous contributions: Nicholas Murray Butler, Karl T. Compton, Edwin G. Conk-

lin, Max Farrand, Arthur W. Goodspeed, John L. Haney, Waldo G. Leland, J. Bertram Lippincott, Samuel Eliot Morison, Roland S. Morris, George W. Norris, A. S. W. Rosenbach, St. George L. Sioussat, and Witmer Stone. (This does not include reprints, etc., received from applicants for grants.)

Non-members also have contributed generously, among whom are:

Greville Bathe	Albert Cook Myers
Irwin Biser	Lawrence C. Wroth
Grace Hall Blashfield	American Red Cross
Clarence S. Brigham	Buhl Foundation
Ralph H. Brown	Carnegie Endowment for International Peace
Howard M. Chapin	Franklin Institute
Harold S. Colton	Free Library of Philadelphia
Watson Davis	Garden Club of America
Mrs. J. R. Delafield	Library of Congress
Edmond J. Farris	Massachusetts Institute of Technology
Grant Foreman	Peabody Museum of Salem
Harrold E. Gillingham	Social Science Abstracts
Elihu Grant	U. S. Geological Survey
George C. Groce, Jr.	U. S. National Park Service
Francis Harper	University of Chicago
James Lewis Hook	Wistar Institute
Alban W. Hoopes	Yale University Library
Lawrence Martin	
Warren K. Moorehead	

Important Purchases Made by the Library.

Representative titles in the different classes are here given:

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- Holmes, Thomas James.** Increase Mather, a bibliography of his works . . . Cleveland, 1931. 2v. Five hundred copies printed at the Harvard University Press for William Gwinn Mather, June 1931.
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- International congresses and conferences, 1840-1937;** a union list of their publications available in libraries of the United States and Canada, edited by Winifred Gregory under the auspices of the Bibliographical Society of America. New York, Wilson, 1938.
- Junk, Wilhelm.** Rara historico-naturalia et mathematica. V. 1-2. Berlin, 1900-1936.
- Leroquais, Victor.** Les pontificaux manuscrits des bibliothèques publiques de France . . . Paris [Macon, Protat Frères], 1937. 4v.
- Martin, John.** A bibliographical catalogue of books privately printed; including those of the Bannatyne, Maitland and Roxburghe clubs, and of the private presses at Darlington, Auchinleck, Lee Priory, Newcastle, Middle Hill, and Strawberry Hill. London, Arch; Payne and Foss; Rodwell, 1834.
- Meynen, Emil.** Bibliographie des Deutschtums der kolonialzeitlichen Einwanderung in Nordamerika, insbesondere der Pennsylvanien-Deutschen und ihrer Nachkommen, 1683-1933. Leipzig, Harrassowitz, 1937.
- Overbeck, Johannes Adolf, comp.** Die antiken Schriftquellen zur Geschichte der bildenden Künste bei den Griechen. Leipzig, Engelmann, 1868.
- Reference catalogue of current literature;** a national inclusive book-reference index of books in print and on sale in the British Empire . . . 1938. London, Whitaker . . . 1938.
- Trade prices current—Press books.** 1937/38 +. New York, Bowker, 1938 +.
- Trade prices current of American first editions . . . 1936/37 +.** New York, Bowker, 1938 +.
- Tucker, Mary.** Books of the southwest, a general bibliography. New York, Augustin [1937].
- U. S. Library of Congress. Periodical Division.** A check list of foreign newspapers in the Library of Congress, newly compiled under the direction of Henry S. Parsons. Washington, Govt. Print. Off., 1929.
- U. S. War Department. Library.** Bibliography of state participation in the Civil War, 1861-1866 . . . 3rd ed. Washington, Govt. Print. Off., 1913.
- University of Cambridge.** The book rarities in the University of Cambridge . . . by the Rev. C. H. Hartshorne. London, Printed for Longman, Rees, Orme, Brown, and Green . . . 1829.
- Wagner, Henry Raup.** The plains and the Rockies, a bibliography of original narratives of travel and adventure, 1800-1865; revised and

extended by Charles L. Camp. San Francisco, Grabborn Press, 1937.

Early Scientific Works before 1700.

[Alencé, Joachim d'.] *Traitez des baromètres, thermomètres, et notiomètres, ou hygromètres*, par Mr. D***. Amsterdam, Chez Henry Wetstein, 1688.

Apianus, Petrus. *Instrvmentvm primi mobilis*, à Petro Apiano nunc primvm et inventvm et in lveem editvm . . . accedunt ijs Gebri filii Affla Hispalensis astronomi uetustissimi pariter & peritissimi, libri ix. de astronomia, ante aliquot secula Arabice scripti, & per Giriardū Cremonensem latinitate donati, nunc uero omnī primum in lucem editi . . . Norimbergae, Apvd Io. Petreivm, M. D. XXXIII.

Bartoli, Cosimo. *Del modo di misurare le distantie, le superficie, i corpi, le piante, le prouincie, le prospettieue, & tutte le altre cose terrene, che possono occorrere a gli huomini* . . . In Venetia, Per Francesco Franceschi Sanese, 1589. Contains marginal notes in manuscript.

Borelli, Giovanni Alfonso. *Confermazione d'vna sentenza del Signor Gio: Alfonso Borelli* . . . di nuouo contradetta dal . . . Stefano de gl'Angeli . . . nelle sue terze considerazioni, prodottada Diego Zerilli. In Napoli, Per Ludouico Cauallo, 1668.

[Boulliau, Ismaël.] *Philolai, sive dissertationis de vero systemate mvndi*, libri iv. Amsterdami, Apud Gvil. & Iohannem Blaeu, CIO IO CXXXIX.

Dodoens, Rembert. *Crydyt-boeck* . . . met biivoeghsels achter elck capitel, uyt verscheyden crydyt-beschrijvers; item, in 't laetste een beschrijvinghe vande Indiaensche ghewassen, meest ghetrocken uyt de schriften van Carolvs Clvsivs; nu wederom van nieuws oversien ende verbeteret. T'Antwerpen, Inde Plantijnsche Druck-erije van Balthasar Moretus, M. DC. XLIV.

Faber, Philippus (Faventinus). *Philosophia natvralis Ioan. Dvns Scoti*, ex qvattvor libris sententiarvm . . . et in cvivs fine additvs est tractatvs brevis facilis, & necessarius in formalitates Scoti, avctore fratre Philippo Fabro Faventino . . . qvinta editio. Venetiis, Apud Haeredes Io. Baptistae Bertoni, sub Signo Peregrini, M DC XXII.

Gabbema, Simon Abbes. *Friesche Iyst-gaarde*; ofte boom- heester- bloem- en kruid-waarande, bestaande uyt der gewassen beschrijvinge, die in Hoog- en Needer-Duyds-land en de aangrenzende landschappen bekend zijn . . . Leeuwarden, By Hendrik Rintjes, MDCLXXXVI.

[Hume, Jacques.] *Spheres de Copernic et Ptolomee: avec l'vsage et construction des tables spheriques de Regiomontanus*. Paris, Chez Lovys Boulenger . . . M. DC. XXXVII.

[Lobel, Matthias de.] *Icones stirpivm, sev plantarvm tam exoticarvm, qvam indigenarvm, in gratiam rei herbariae studiosorum in duas*

- partes digestae; cum septem linguarum indicibus . . . Antverpiae, Ex Officina Plantiniana, apud Vidvam et Ioannem Moretvm, M. D. XCI. 2v. in 1.
- Longomontanus**, Christian Severin. *Controversiae de verâ circuli mensurâ anno CIO IO CXLIV exortae, inter Christianvm Severini, Longomontanvm . . . et Ioannem Pellivm . . . Amstelodami, Apud Ioannem Blaev, CIO IO C XLVII.*
- Meister**, George. *Der Orientalisch-Indianische Kunst- und Lust-Gärtner . . . Dresden, In Verlegung des Autoris, druckts Johann Riedel, 1692.*
- Porta**, Giambattista della. . . De refractione optices parte:—libri nouem . . . Neapoli, Apud Io. Iacobum Carlinum, & Antonium Pacem, 1593.
- Porzio**, Simone. *De rerum natvralivm principiis . . . libri duo . . . Neapoli, Excudebat Matthias Cancer, M. D. LIII. Contains manuscript marginalia.*
- Snell**, Willebrod. *Coeli & siderum in eo errantium observationes Hassiacae, illustrissimi principis Wilhelmi Hassiae . . . et spicilegium biennale ex observationibvs Bohemicis v. n. Tychoonis Brahe. Nunc primum publicante Willebrordo Snellio; quibus accesserunt, Ioannis Regiomontani & Bernardi Walteri . . . Lvgdvni Batavorvm, Apud Iustvm Colstervm, CIO IO CXVIII.*
- Snell**, Willebrod. *Cyclometricvs, de circuli dimensione secundum logistarum abacos, & ad mechanicem accuratissima; atque omnium parabilissima . . . Lvgdvni Batavorvm, Ex Officina Elzeviriana, CIO IO CXXI.*
- Stöffler**, Johann. *Elveidatio fabricae vsvsque astrolabii, Ioanne Stoflerino Iustingensi autore. Lvtetiae, Apud Gulielmum Cauellat . . . 1553.*
- [**Tabernaemontanus**, Jacobus Theodorus.] *Eicones plantarvm, sev stirpivm, arborvm nempe, frveticvm, herbarvm, frvettvm, lignorvm, radicum, omnis generis . . . adiecto indice gemino locupletissimo; curante Nicolao Bassaeo. Francofvrti ad Moenvm, M. D. XC.*
- Tartaglia**, Nicolo. *Qvesiti et inventioni diverse . . . di novo restampati con vna giunta al sesto libro . . . (Colophon) In Venetia, Per Nicolo de Bascarini . . . M D LIII.*

Astronomy, Physics.

- Boscovich**, Roger Joseph. *De solis ac lunae defectibus, libri v . . . editio Veneta prima ex exemplari editionis Londinensis anni 1760 . . . Venetiis, Typis Antonii Zatta, MDCCLXI.*
- Boscovich**, Roger Joseph. *Memorie sulli cannocchiali diottriei . . . In Milano, Nella Stamperia di Giuseppe Marelli, MDCCLXXI.*
- Heller**, August. *Geschichte der Physik. Stuttgart, Enke, 1882-1884. 2v.*
- Molynaux**, William. *Dioptrica nova; a treatise of dioptricks, in two parts . . . 2nd ed. London, Printed for Benj. Tooke, MDCCIX.*

Nobili, Leopoldo. Nuovi trattati sopra il calorico, l'elettricità e il magnetismo . . . Modena, Per Gli Eredi Soliani . . . 1822.

Botany, Agriculture, Forestry.

Hooker, Sir Joseph Dalton. Notes of a tour in the plains of India, the Himala, and Borneo; being extracts from the private letters of Dr. Hooker, written during a government botanical mission to those countries. Pt. 1—England to Calcutta. London, Reeve, Benham, and Reeve, 1848.

La Quintinye, Jean de. The compleat gard'ner; or, Directions for cultivating and right ordering of fruit-gardens and kitchen-gardens; with divers reflections on several parts of husbandry. In six books . . . made English by John Evelyn. London, Printed for Matthew Gillyflower . . . and James Partridge, MDCXCIII.

Lindley, John. Rosarum monographia; or, A botanical history of roses; to which is added, an appendix, for the use of cultivators . . . London, Printed for James Ridgway, 1820.

Miyabe, Kingo. Icones of the essential forest trees of Hokkaido, by Kingo Miyabe . . . and Yushun Kudo . . . drawn by Chusuke Suzuki. Published by the Hokkaido Government, 1925-1932. 3v.

Zahlbruckner, Alexander. Catalogus lichenum universalis. Leipzig, Gebrüder Borntraeger, 1922-[1934]. 9v.

Art and Archaeology.

British Museum Expedition to Middle Egypt, 1928, 1929. Mostagedda, and the Tasian culture, by Guy Brunton. London, Quaritch, 1937.

Christian, Viktor. Altertumskunde des Zweistromlandes. Bd. 1+. Leipzig, Hiersemann [1938+].

Dunlap, William. A history of the rise and progress of the arts of design in the United States . . . a new edition . . . by F. W. Bayley and C. E. Goodspeed. Boston, Goodspeed, 1918. 3v.

Gerstinger, Hans. Die griechische Buchmalerei. Wien, Österreichische Staatsdruckerei, 1926. 2v.

Kekulé von Stradonitz, Reinhard, ed. Die antiken Terracotten im Auftrag des Archäologischen Instituts des Deutschen Reichs. Stuttgart, Spemann, 1880-1911. 4v. in 6.

Mauro, Amedeo. La casa del Menandro e il suo tesoro di argenteria. [Roma] La Libreria dello Stato [1933].

Mauro, Amedeo. La villa dei misteri. Roma, La Libreria dello Stato, 1931. 2v.

Mezzabarba, Francisco. Imperatorum romanorum numismata . . . a Francisco Mediobarbo Birago . . . curante Philippo Argelato Bononiensi. Mediolani, Ex Aedibus Societatis Palatinae, MDCCXXX.

Mond, Sir Robert. Cemeteries of Armant I, by Sir Robert Mond and Oliver H. Myers. London, Egypt Exploration Society, 1937. 2v.

Rowland, Benjamin, Jr. The wall-paintings of India, Central Asia & Ceylon, a comparative study . . . with an introductory essay on

- The nature of Buddhist art by Ananda K. Coomaraswamy. Boston, Merrymount Press, 1938. No. 94 of an edition of 500 copies.
- Schliemann, Heinrich. Heinrich Schliemann's Sammlung trojanischer Altertümer, beschrieben von Hubert Schmidt. Berlin, Reimer, 1902.

Biography.

- Chinard, Gilbert. Honest John Adams. Boston, Little, Brown, 1933.
- Ampère, André Marie. Correspondance du grand Ampère, pub. par L. de Launay . . . Paris, Gauthier-Villars, 1936. 2v.
- Ball, John. John Ball, member of the Wyeth expedition to the Pacific northwest, 1832; and pioneer in the old northwest; autobiography compiled by his daughters, K. B. Powers, F. B. Hopkins, and Lucy Ball. Glendale, Calif., Clark, 1925.
- Clark, William Bell. Gallant John Barry, 1745-1803; the story of a naval hero of two wars. New York, Macmillan, 1938.
- Gassendi, Pierre. Tychonis Brahei . . . vita . . . accessit Nicolai Copernici, Georgii Peurbachii, & Joannis Regiomontani, astronomorum celebrium, vita, editio secunda . . . Hagae-Comitvm, Ex Typographia Adriani Vlacq, M.DC.LV.
- David, Robert Beebe. Finn Burnett, frontiersman. Glendale, Calif., Clark, 1937.
- Curie, Eve. Madame Curie, a biography . . . translated by Vincent Sheean. Garden City, Doubleday, Doran, 1938.
- Alexander, Edward Porter. A revolutionary conservative, James Duane of New York. New York, Columbia University Press, 1938.
- Bigelow, John. Memoir of the life and public services of John Charles Fremont. New York, Derby & Jackson, 1856.
- Leroux de Lincy, Adrien Jean Victor. Recherches sur Jean Grolier sur sa vie et sa bibliothèque, suivies d'un catalogue des livres qui lui ont appartenu. Paris, Potier, 1866.
- Jackson, Chevalier. The life of Chevalier Jackson, an autobiography. New York, Macmillan, 1938.
- Marshall, John. An autobiographical sketch by John Marshall, written at the request of Joseph Story and now printed for the first time from the original manuscript preserved at the William L. Clements Library, together with a letter from Chief Justice Marshall to Justice Story relating thereto; edited by John Stokes Adams. Ann Arbor, University of Michigan Press, 1937.
- Berthold, S. M. Thomas Paine, America's first liberal. Boston, Meador, 1938.

History and Travel.

- Bolton, Herbert Eugene. Anza's California expeditions . . . Berkeley, University of California Press, 1930. 5v.
- Historische und geographische Beschreibung von Neu-Schottland . . . Frankfurt und Leipzig, Bey Heinrich Ludwig Brönnner, 1750. The map is by Thomas Jefferys.

- Kalm**, Pehr. Peter Kalm's Travels in North America; the English version of 1770 revised from the original Swedish and edited by Adolph B. Benson . . . with a translation of new material from Kalm's diary notes. New York, Wilson-Erickson, 1937. 2v.
- Mills**, Robert. Atlas of the state of South Carolina . . . a new facsimile edition of the original published in 1825; with an introduction by Francis Marion Hutson. Columbia, S. C., L. H. Bostick and F. H. Thornley, 1938. No. 66 of an edition of 350.
- Stieler**, Adolf Karl. Stieler's Atlas of modern geography . . . published by Hermann Haack . . . 10th ed., internat. ed. Pts. 1-34. Gotha, Perthes, 1934-1938.

Frankliniana.

- Franklin**, Benjamin. The life of Doctor Benjamin Franklin, written by himself. 4th American ed. Wilmington, Brynberg, 1799.
- Franklin**, Benjamin. Profile of genius, Poor Richard pamphlets edited by Nathan G. Goodman for the Franklin Institute. Philadelphia, Franklin Institute, c1938.
- [**Franklin**, Benjamin.] The way to wealth, as clearly shewn in the preface of an old Pennsylvania almanack intituled, Poor Richard improved. [London] Printed for W. Brown [1774?].
- Franklin**, Benjamin. Works of the late Dr. Benjamin Franklin . . . Huntingdon: Printed for the Proprietor, 1800.
- Nolan**, J. Bennett. Benjamin Franklin in Scotland and Ireland, 1759 and 1771. Philadelphia, University of Pennsylvania Press, 1938.
- Van Doren**, Carl. Benjamin Franklin. New York: The Viking Press, 1938.
- Ellwood**, Thomas. Davideis: the life of David, king of Israel . . . 4th ed. London printed: Philadelphia reprinted, and sold by B. Franklin, and D. Hall . . . MDCCLII.
- Woolman**, John. Considerations on keeping negroes . . . part second. Philadelphia, Printed by B. Franklin, and D. Hall, 1762.
- [**Wollaston**, William.] The religion of nature delineated. London, S. Palmer, 1725.
- "Benjamin Franklin arrived in London, December 24, 1724, and was employed at S. Palmer's printing office. While there he worked as a compositor on *The religion of nature delineated* . . ." *Curtis Collection of Franklin imprints*, by W. J. Campbell.
- Mercure de France**: five numbers, Sept. 11, 1790; Feb. 12, June 25, Oct. 8, 1791; Sept. 27, 1795. Paris.
- These numbers contain articles by or pertaining to Franklin. The number for Sept. 1795 contains one of the earliest printings of Franklin's *Economical Project* which is thought to be the forerunner of today's "daylight saving."
- Engravings**. Thirty-three engraved portraits of Benjamin Franklin.
- (For manuscript accessions see Part II of this report.)

In addition to the above mentioned accessions, the Library has purchased a collection of seventy-seven pamphlets dealing with Mexican and Central American railways. Also purchased, from duplicates in the Henry E. Huntington and John Carter Brown Libraries, were thirty-four books and pamphlets of early Americana. These included several Washington funeral orations which add to our already interesting collection of eulogies on our First President.

Acquisition of Serials.

During 1938 the Library has received 1,800 serial publications of which 310 have been acquired by gift, 1,175 by exchange, and 315 by purchase. The last are credited to the various funds as stated above. One hundred new serials have been added during the year. Among them are the following:

By Purchase.

- Acta ethnologica.** 1936, 1 +. Kopenhagen, Levin & Munksgaard, 1936 +.
- Agricultural history.** V. 1 +. Chicago, Agricultural History Society, 1927 +. Supersedes the *Papers* of the Agricultural History Society.
- Archiv für Papyrusforschung und verwandte Gebiete . . .** herausgegeben von Ulrich Wilcken. Bd. 1 +. Leipzig, Teubner, 1900 +.
- Chronica botanica;** an annual record of pure and applied botany, edited by Fr. Verdoorn in collaboration with an advisory and numerous assistant and corresponding editors. V. 1 +. Leiden, 1935 +.
- The Colophon,** a book collectors' quarterly. No. 1 +. New York, 1930 +.
- Gazzetta ufficiale del regno d'Italia.** An. 79 +. Roma, 1938 +.
- International encyclopedia of unified science;** editor-in-chief, Otto Neurath. V. 1 +. Chicago, University of Chicago Press, 1938 +. V. 1-2 are entitled: Foundations of the unity of science.
- The Journal of documentary reproduction;** a quarterly review of the applications of photography and allied techniques to library, museum and archival service. V. 1 +. [Chicago, American Library Association, 1938 +.]
- Revue française d'héraldique et de sigillographie;** organe de la Société Française d'Héraldique et de Sigillographie. T. 1 +. Paris, 1938 +.

By Exchange.

- Illinois State Historical Society.** Papers in Illinois history and transactions. 1937 +. Springfield, 1938 +.
- Institut de France.** Académie des Sciences. Notices et discours. T. 1 +. Paris, Gauthier-Villars, 1937 +.
- Naturalia;** revista trimestral de divulgação, publicada pela Sociedade Portuguesa de Ciências Naturais. V. 1 +. Lisboa, 1936 +.
- Nouvelles de la chimie;** organe mensuel d'information du Centre de Documentation Chimique. No. 37 +. Paris, 1938 +.
- Société d'Histoire et d'Archéologie de Genève.** Bulletin. T. 6, livr. 3 +. Genève, Jullien, 1937 +.
- Stockholm. K. Svenska Vetenskaps-Akademien.** Avhandlingar i naturskyddsärenden. No. 1 +. Stockholm, Almqvist & Wiksells, 1938 +.

By Gift.

- Instituto Panamericano de Geografia e Historia.** Revista de historia de America. No. 1 +. Mexico, 1938 +.
- Pennsylvania Federation of Historical Societies.** Yearbook. 1938 +. Harrisburg, 1938 +.

Files Completed.

Through a gift, of the parts indicated below, the following file has been completed:

- International Committee of Historical Sciences.** Bulletin. No. 1-5, 11-17.

Binding, Cataloguing, etc.

During 1938, 744 volumes have been bound and 1,672 volumes accessioned, of which 851 were serial publications. There have been catalogued 638 books in 856 volumes, 204 pamphlets, 11 maps, 29 manuscripts, 30 autographs, 1 broadside, 4 bookplates, 5 photo-stats. Of serials analyzed 1,246 titles have been brought out; 7,523 cards have been added to the catalogue, of which 2,897 were typewritten and 4,626 were Library of Congress cards to which changes and additions were made to adapt them to our catalogue.

Calendaring of Manuscripts.

Work on the Bache Collection of Franklin Papers is nearing completion. While the calendar will not be printed for perhaps another year a card index of the manuscripts soon will be ready for use by research students.

Approximately 1,500 items have been added to the original group of the Elihu Thomson Papers which was presented in 1937 by Mrs. Thomson, Dr. Thomson's sons, and the General Electric Company. About 1,000 of these comprise additional pieces sent by Mrs. Thomson, and include early diaries and papers, certificates and diplomas, and the correspondence of the last five years of Dr. Thomson's life. The other items have been presented by various associates of Dr. Thomson to whom letters were addressed stating the original gift and asking for supplementary material. The response has been very gratifying inasmuch as ninety per cent of the material consists of letters from Dr. Thomson, either autographed or typed. In addition, the General Electric Company has presented twenty volumes of letter-books covering the period 1883-1902.

Care and Repair of Books and Manuscripts.

The close of 1938 sees the completion of practically all of the letters in the Bache Collection of Franklin Papers, the greater part of the miscellaneous manuscripts, and some of the accounts. The work of flattening the parchment documents also has been going on steadily. The apparatus made for this process is similar to that employed by the British Museum in the restoration of the *Codex Sinaiticus*.

After restoration the manuscripts are placed in paper folders and the folders arranged in substantial boxes made for the purpose. It was essential to obtain a paper free from injurious chemicals for the folders and after a thorough investigation and analyses of different papers, a safe paper has been selected and is now in use. We have obtained also a pure filter paper and our priceless document *The Charter of Liberties*, which was restored last year, is now backed in its frame with a padding of chemically pure filter paper.

Manuscripts Consulted.

The following are some of the manuscripts consulted by students and research workers during 1938:

Samuel Breck. Recollections of Deceased Members of the American Philosophical Society.

The Burd-Shippen Papers.

Peter S. DuPonceau. Commonplace Book.

George Fox. Letter Book.

The Franklin Papers.
 The Horsfield Papers.
 Minutes of the Indian Affairs.
 Papers of the Indian and Military Affairs of Pennsylvania.
 Thomas Jefferson. Letters.
 B. A. Konkle. Life and Writings of James Wilson.
 The Lewis and Clark Journals.
 The Arthur Lee and Richard Henry Lee Papers.
 The Logan Papers.
 The Muhlenberg Journals.
 Israel Pemberton. Letter Book.
 Record of Indentures.
 The Elihu Thomson Papers.
 The Weedon Papers.
 Photostatic copies of the Franklin Papers from the Pierpont Morgan Library.

Inter-Library Loan.

Among the borrowers on the inter-library loan system are :

Academy of Natural Sciences, Philadelphia.
 Bangor Public Library, Bangor, Pennsylvania.
 Beaver College, Jenkintown, Pennsylvania.
 Drexel Institute of Technology, Philadelphia.
 Franklin Institute, Philadelphia.
 Girard College Library, Philadelphia.
 Historical Society of Pennsylvania, Philadelphia.
 Lafayette College Library, Easton, Pennsylvania.
 Lehigh University Library, Bethlehem, Pennsylvania.
 Princeton University Library, Princeton, New Jersey.
 Smithsonian Institution, Washington, D. C.
 Swarthmore College Library, Swarthmore, Pennsylvania.
 Temple University, Philadelphia.
 University Museum Library, Philadelphia.
 Virginia State Library, Richmond, Virginia.

Exhibits of the Books and Manuscripts from the Library.

Joint Meeting with Representatives of Organizations and Institutions Concerned with the Publication of Research, February 18-19, 1938.

A collection of books and pamphlets illustrative of Franklin's work as publisher and printer.

Jayne Memorial Lecture, Delivered by Dr. Karl T. Compton, President of the Massachusetts Institute of Technology, March 15, 1938.

Material, manuscript and printed, pertaining to Joseph Priestley.

Exhibition, March 23-May 18, 1938.

Material, manuscript and printed, pertaining to Mexico, embracing its archaeology, botany, history, ethnology, linguistics, and ecclesiastical history.

Exhibition, March 23-April 21, 1938.

Twenty-three editions of Franklin's *Way to Wealth*.

The Annual General Meeting of the Society, April 21-23, 1938.

Material, manuscript and printed, illustrative of the early history of the Society.

Exhibition, May 18, 1938.

Selection of manuscripts, books and pamphlets, illustrative of the "Many-Sided Franklin."

Autumn General Meeting of the Society, November 18-19, 1938.

[Symposium—Intrinsic and Environmental Factors in American Population Growth.]

Material, manuscript and printed, illustrative of the problems of population.

In-Use and Out-Use of the Library.

During 1938, 110 books were borrowed by members of the Society and on inter-library loan. In addition to these, 91 loans were made to members of the Library staff.

Exclusive of members who visited the Library on dates of the Society's meetings, 398 persons were registered as using the Library during the year.

The Library also has rendered valuable service through correspondence. Many letters, asking for information on various subjects, have been received. Often these questions have meant much research work on the part of the staff, and the requested data either have been supplied or shown that the information was not available from our resources.

Financial Statement.

Books and Binding and General Expenses.

Carried forward from 1937	\$ 1,186.20
Appropriation for 1938	9,900.00
Transferred from Miscellaneous Fund	500.00
	\$11,586.20
Expended during 1938	10,979.20
Balance 12/31/38	\$ 607.00

Special Library Funds.

Balances			Transferred	Balances
1/1/38	Incomes	Expended	Principal	12/31/38
\$5,021.94	\$7,664.14	\$5,170.78	\$1,221.29	\$6,294.00

Salaries.

For 1938	\$9,892.50
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II. REPORT OF THE CHAIRMAN OF THE COMMITTEE ON THE LIBRARY

The Library Committee: Personnel, Meetings and Policy.

In accordance with the plan now prevailing, the four regular meetings of the Committee on the Library were held at two o'clock on the afternoons of March 23, May 18, October 19, and December 21, 1938.

The membership of the Committee consists of St. George L. Sioussat, *Chairman*, George A. Barton, Rhys Carpenter, Waldo G. Leland, William E. Lingelbach, Horace C. Richards, Harlow Shapley, A. S. W. Rosenbach, and Roland S. Morris, *President*; Edwin G. Conklin, *Executive Officer*, sits with the Committee. The resignation of Professor Rodney H. True, after the first meeting of the year, was received by the Committee with great regret and with a resolution expressing appreciation of his many and valuable services. The President appointed Dr. A. S. W. Rosenbach to fill this vacancy.

The usual matters of routine have come before the Committee, and the results of its deliberations have already been noted in the report of the Librarian.

Mexican Materials, Manuscript and Printed.

In last year's *Report* (p. 29) mention was made of the Library's possessions which have to do with the history, archaeology and linguistics of Mexico. From time to time, in recent years, the Library has purchased various printed and manuscript Mexican papers; and the Committee resolved to look more carefully into the wisdom of this policy, in order to decide whether it should be maintained. In this investigation the Library has continued to have the advice of Professor Arthur P. Whitaker of the University of Pennsylvania.

The results of the examination were very reassuring. The collection of works in the Library appears to represent many fields and to be especially rich in linguistics. Three rare incunabula were found and, among other special treasures, three manuscript maps dated 1785, 1796, 1823.

Of the many who have contributed to the Mexican and Latin American possessions of the Society, perhaps the earliest was Joel R. Poinsett, the first minister of the United States to Mexico.

Among the "antiquities" which he brought back with him were four pages of a pictograph document which is described as a tribute roll of Montezuma. In the course of a lengthy correspondence with the officials of the National Museum of Mexico City, it has been found that these four pages constitute a part of a volume in the possession of that Museum. This material was described and reproduced in the notable work *Monumentos del Arte Mexicano Antiguo*, by Antonio Peñafiel, Berlin, 1890. The four pages in the possession of the Society, together with two additional pages of another document, were carefully reproduced in facsimile in the Society's TRANSACTIONS, N. S. Vol. 17, 1893.

During the last year, the earnest request of the National Museum of Mexico that the Society should return to Mexico the missing pages of the tribute roll has received the most careful consideration and it is hoped that a satisfactory solution of the problem raised by the request may be forthcoming within the next year.

The Archives of the Society.

In the *Report* of last year it was said that the investigation of the archival papers of the Society had reached about the year 1825. It may now be stated that this examination has been completed practically throughout the year 1873, at which date begins the modern series of filing boxes which has been continued from that time on. Moreover, the work of rearranging these papers has been begun. When this is completed and a proper finding list is made, the next undertaking will be the preparation of the catalogue of the manuscript collections of the Society, to which reference has been made in our previous reports.

It is a source of satisfaction to know that the loose papers of the Society's archives are no longer in miscellaneous bundles, boxes, and containers of all sorts, but in uniform manuscript cases, specially made for the purpose, with duplicate cards for each piece or group of related pieces. Each item is preserved in a folder, of a paper carefully selected after consultation with the Library of Congress with a view to the maximum of protection and the minimum of possible harm to the old documents from the standpoint of chemical action.

The Microfilm Equipment.

In the course of the present year an important change has been made in the photographic service of the Library. Work with the Graflex Photorecord Camera was begun in July 1937, under the administration of Dr. Alban W. Hoopes. Various alterations in the camera were needed, and the question of the space and time required for the operation of the camera in the work of copying and enlarging manuscripts and books raised some difficult problems. Nevertheless, orders were filled and, in addition, the beginnings made for a dark room for the necessary photographic processes. Experience has shown, however, that the demands of this branch of the Library's activities could better be met by a trained technician. The Committee has considered itself fortunate in securing the services of Dr. John J. Heilemann, upon a part-time basis, to take care of this photographic work. This has restored to Dr. Hoopes, for his archival work, much of the time previously devoted to the microfilm apparatus. Under the management of Dr. Heilemann, a "photoduplication service" has been set up with a definite plan of work and a printed statement of the terms upon which copying and enlarging may be done.

The Library has made it a policy to keep a duplicate of all materials sent out. Formerly this necessitated photographing items twice in order to make a duplicate continuous strip of negatives. Now, having acquired a device for printing positives on 35 mm film, only one strip of negative film has to be made, from which any number of prints may be taken. Improvements have been made in the methods of identification of copied items, as well as in the technical processes. The Library is ready now to make positive films, and to furnish enlargement prints or lantern slides. With Kodachrome film, copying in color may be done.

With the assistance and cooperation of the Free Library of Philadelphia, which allowed the use of its ultra-violet machine, experiments were made by Mr. Richard E. Deats, an experienced photographer, in the photographing of documents; particularly an old letter from Peter Franklin in which the ink had apparently faded out entirely. By the use of a long exposure of the ultra-violet fluorescent rays, the greater part of the writing was recaptured. The Library is now equipped with a small ultra-violet machine, and Dr. Heilemann has obtained very satisfactory results.

The Old Custom House and the Library.

In the course of the last year or two there have been presented to the American Philosophical Society various suggestions looking toward the possible acquisition of the old Custom House with a view to its adaptation for the purposes of a library building for the Society. The old Custom House, which fronts on Chestnut Street standing next to the Drexel Building, was originally the home of the Second Bank of the United States. At the annual meeting on April 22, 1938, it was voted by the Society that the Committee on Finance should be authorized to spend a substantial sum for reports by an architect and engineer as to the condition of the Custom House.

To the Committee on the Library this matter was first presented officially by the Executive Officer on June 7, when the Chairman was invited to attend a meeting of a sub-committee of the Committee on Finance. At this meeting, held June 13, Dr. William E. Lingelbach and Dr. Leicester B. Holland also were present. Following this meeting, the President requested that the Committee on the Library prepare a fairly detailed outline of the needs and requirements, in the Committee's view, that would attach to any new library building. To this end the Librarian, with some suggestions from the Chairman and others, drew up, during the summer, a detailed statement providing the desired information. This statement, approved by the Committee on the Library at its first meeting in the fall, was meanwhile submitted to the President, in whose hands the matter now rests.

The Librarian's statement was prepared with great care, after correspondence with the officers of several other libraries and after the consultation of published works on library construction and the printed reports that bore on the subject.

It is the feeling of the Chairman, and, he believes, that of the Committee, that if it should prove to be the fact that the Custom House building could be comfortably and without too great expense converted into an adequate library building, it would be highly desirable to acquire such a permanent depository for our treasured books and manuscripts. Obviously, the location is a most convenient one; and the opportunity to preserve a structure so important, both from the artistic standpoint and from that of our economic and political history, would be lost with regret. It

should be distinctly borne in mind, however, that the needs of the Library must be paramount to any considerations of sentiment. It would be a serious mistake to force the Library, for whatever reason, into a building that did not lend itself to library uses.

Acquisitions of Manuscript Material.

While welcoming as gifts, or deposits on loan, any manuscript materials which may be of service to students of the history of American life and thought, the Committee on the Library has steadily pursued the policy of deliberately limiting to a very narrow field its purchases of manuscripts. A rigid adherence to this principle has compelled the Library to forego buying much that has been offered to it.

The basic collection of Benjamin Franklin Papers is, of course, that acquired nearly a century ago from Charles P. Fox and his sister, Mary Fox, through the good offices of Jared Sparks. The purchase of the Bache Collection, very recently, largely increased the usefulness of the Society's Franklin Papers for research in respect to the history of Benjamin Franklin and his times. Within the past year, it is a pleasure to say, the Library has been able to increase further its holding of Franklin manuscripts through the purchase of two minor groups. The first of these we may describe as the Franklin-Stevenson correspondence; the second comes from a branch of the Bache family, but is quite distinct from the Bache Collection to which reference has just been made.

When Jared Sparks, the historian and editor, was collecting materials for his *Writings* of Franklin, the first fruit of his efforts was a little volume entitled *A Collection of the Familiar Letters and Miscellaneous Papers of Benjamin Franklin; Now for the First Time Published*, Boston . . . 1833. This work, now rather rare, included many letters by Benjamin Franklin to Mary, better known as Polly Stevenson, a young English girl who was the daughter of Mrs. Margaret Stevenson, the landlady of the house in Craven Street where Franklin sojourned during his periods of residence in England as colonial agent. Between these two there developed a friendship expressed in part in a correspondence which lasted from 1758 until 1786, by which time Polly Stevenson had married Dr. William Hewson and had become the mother of three children. After the untimely death of Dr. Hewson, his widow, urged by Dr.

Franklin, had brought her children to visit the American Minister in France. Later, but before the death of the philosopher, she, with her children, had left England and come to Philadelphia, where her descendants grew into a goodly number.

The letters which Franklin wrote to his friend were kept for the most part in some branch of the family of Mrs. Hewson until 1920, when a large group was put up at auction and sold to different owners. Ten of these were purchased by the Library of Congress, which already possessed a few from other sources.

During this past year the Library of the American Philosophical Society has been so fortunate as to buy, from another branch of Mrs. Hewson's descendants, no less than thirty of Franklin's letters to Polly Stevenson. Already owning a few in the Franklin Papers, the Society now has acquired the largest group of this correspondence in the possession of any single person or institution, and has prevented the further scattering of these letters. More than that, several of the letters now purchased have not been published, even by Sparks in the work of 1833.

A second group of papers closely connected with Benjamin Franklin comes from a branch of the Bache family, and contains letters from Franklin's son, William Franklin, at one time the Loyalist Governor of New Jersey; from his grandson, W. T. Franklin; and from various members of the Bache family. This smaller collection supplements usefully both the Franklin Collection and the Bache Collection.

Among individual manuscript items added to the Society's collection of Frankliniana attention may be centered on a document signed by Benjamin Franklin as Minister Plenipotentiary, at Passy, November 16, 1782, commanding "All Captains and Commanders of Vessels of War, Privateers and Letters of Marque Belonging to the United States of America" to respect passports of certain English vessels which were to carry mail between Dover and Calais; and also a letter from William Temple Franklin, dated from Rouen, July 16, 1785, just before Franklin's departure for America.

In addition to its purchases, the Committee has acquired copies of valuable Franklin manuscripts through the generosity of individuals or other institutions. In this respect, the Committee on the Library is much indebted to the Librarian of the Pierpont Morgan Library in New York for permission to secure photostats

of all its Franklin material. Copies of individual letters have been presented by Mr. Randolph G. Adams of the William L. Clements Library, Ann Arbor, Michigan; and by Mr. Charles B. Montgomery of Philadelphia. In the first case the original is in the possession of Mrs. J. W. Williams, St. Andrews, Scotland; and the second, in that of the Library Company of Philadelphia. From the Library of Congress have been procured photostats of the index cards for the Papers of the Continental Congress referring to Benjamin Franklin, and of the pages of the Stevens index which pertain to Benjamin, to William, and to William Temple Franklin. Thus, the student coming to the Library of the American Philosophical Society is able to acquaint himself with Franklin materials in these other institutions—a matter which may result in considerable saving of time. It is hoped to carry to a much larger extent this plan of securing lists and indexes from other libraries.

Manuscript accessions, other than those in the field of Frankliniana, include certain papers pertaining to the claims of American loyalists, and an ordinance respecting suits for the recovery of debts passed by the General Assembly of the state of South Carolina in March 1784. Two Jefferson letters were acquired; the one, dated April 11, 1793, written to David Rittenhouse, pertains to the instructions which the American Philosophical Society was to frame for André Michaux's proposed journey to the western country; the other, to John Vaughan, dated February 18, 1818, mentions the death of Dr. Caspar Wistar and suggests the continuation of Dr. Wistar's weekly assemblies, out of which grew the famous Philadelphia institution, the Wistar Party, still existent and still meeting throughout the winter months occasionally in the Hall of the Society.

With a special appropriation from the Society, Burton Alva Konkle's unpublished *Life and Writings of James Wilson, 1742-1798*, was purchased.

In the TRANSACTIONS of the Society, Vol. 6. 1809, is this record:

On Monday, February 6th, 1804. At Northumberland, Pennsylvania, which had of late years been the place of his residence—died, The Rev. JOSEPH PRIESTLEY, L.L.D., F.R.S. He was chosen a Member of the "American Philosophical Society, held at Philadelphia" on the 22d January, 1785.

At a Stated Meeting, Feb. 17, 1804, *It was resolved unanimously,*

THAT a member of the Society be appointed to deliver an Enlogium on the death of their late eminent Associate, Joseph Priestley, and that a

special meeting of the Society be held on the 24th inst. at 6 P.M. for the purpose of electing the member who shall deliver it.

At a Special Meeting, Feb. 24, 1804, Benjamin Smith Barton, M.D., one of the Vice-Presidents of the Society, was chosen to deliver the Eulogium, as directed by the resolve of the 17th instant.

In the Minutes of January 18, 1805, is the following:

Eulogium on Priestley ordered in the next Volume of Transactions.

There is no record that this "Eulogium" ever appeared in print, nor was any trace of the manuscript found. But recently, Mrs. J. R. Delafield of New York, who is a descendant of Dr. Barton, and who has inherited many of his papers, discovered among these some fragmentary notes of the "Eulogium on Priestley," about six pages in all. These she had photostated and presented a copy thereof to this Library, in January 1938. This is indeed a valuable acquisition.

Cooperative Activities.

Dr. Lawrence C. Wroth of the John Carter Brown Library and Mr. H. M. Lydenberg of the New York Public Library, chief sponsors of a plan for a cooperative endeavor looking to the production of a joint catalogue of eighteenth century Americana, extended an invitation to the American Philosophical Society to be represented upon the part of the Society's Library at a conference which was held at the New York Public Library on November 11, 1938. The Library was represented by the Chairman of the Committee, the Librarian and Assistant Librarian. After a long and interesting discussion, which was pleasantly interrupted by an adjournment to lunch at the Princeton Club, the further promotion of the plan was referred to a committee. The Library of the American Philosophical Society was concerned chiefly with that part of the plan which looked towards the utility of securing a chronological list of the Society's eighteenth century printed material published in America or relating to America. While the holdings of the Society's Library, as to the whole field, appear small in contrast with those of the great libraries, nevertheless in some special periods and topics, such as American interest in science, imprints by Franklin, and works about him, the Library will make a respectable showing, and it is to be hoped that due

support will be given to this important undertaking as it is developed into a definite program.

After the receipt of information that revealed a difficult financial situation in respect to the continuation of the series of bibliographies, *Writings on American History*, published annually under the editorship of Grace Gardner Griffin by the United States Government with the support of the American Historical Association and other societies, institutions, and individuals interested in American history, the Library Committee voted for this one year a special subscription to this cause; for which action grateful acknowledgment has been received from the Executive Secretary of the American Historical Association.

Of the many imprints issued by the press of Benjamin Franklin and that of Franklin and Hall one important series, between 1737 and 1763, comprised narratives of negotiations with the Indian tribes. There were thirteen of these publications, of which the Library of the American Philosophical Society has all but three. Five of the ten the Library loaned to the Historical Society of Pennsylvania, on the request of that body, for publication in the work edited by Mr. Julian P. Boyd, *Indian Treaties Printed by Benjamin Franklin, 1736-1762*.

The Committee acknowledges the very kind cooperation of the Massachusetts Historical Society in allowing our Library to have photostatic copies of the cards for the Jefferson Papers in that Society. With these cards, and with the *Calendars* of the Jefferson Papers (now in the Library of Congress), prepared many years ago by the Bureau of Rolls and Library of the Department of State of the United States, the student in Philadelphia, without leaving the Library of the American Philosophical Society, can locate most of the known papers of Mr. Jefferson.

4. REPORT OF THE COMMITTEE ON PUBLICATIONS

The Laws of the Society provide "that there shall be a *Committee on Publications*, consisting of the President, *ex-officio*, and of not fewer than six other members, representative of the four Classes, who shall serve for three years, and who shall be nominated by the President and elected by the Council" (Chap. V, Art. 8). While election to the Committee is for a three-year term there is no provision against the reelection or appointment of persons to fill out the terms of those who resign or cease to be members. The members of the Committee for 1938-39 and the dates of their first appointments are as follows: Cyrus Adler, 1932, *Chairman*, 1938; Frank Aydelotte, 1936; Edwin G. Conklin, 1932; John A. Miller, 1925; Ernest M. Patterson, 1938; Jacob R. Schramm, 1938; Harold C. Urey, 1938; James T. Young, 1933; Roland S. Morris, *President*, and Arthur W. Goodspeed, *Editor*.

In the death of Dr. Henry H. Donaldson on January 23, 1938, the Committee suffered a very great loss. Dr. Donaldson had been Chairman of the Committee since 1932 and had devoted much time and thought to our publications and their distribution. He was chiefly responsible for the establishment of our new series of MEMOIRS and had taken a leading part in the acceptance of monographs for this series as well as for the TRANSACTIONS. This Committee as well as the entire Society will sadly miss his dependable cooperation and his genial personality. Fortunately, Dr. Cyrus Adler, who has long been a member of the Committee and has had large experience in editorial work and in scholarly publication, has accepted the Chairmanship of the Committee. The Committee lost, by resignation during the past year, Dr. Oswald Veblen who was appointed to the Committee in 1936. He gave much attention to the reorganization of our publication program and he and Dr. Swann served as a special committee on this subject. Their report will be found on page 92 of this section.

For several years past there has been much discussion of the publication program of the Society and of possible methods of improving it. In 1935 the proposal was made to divide all the Society's publications into two series, A and B, the former con-

taining contributions in the fields of Classes I and II and the latter in those of Classes III and IV. After discussion this proposal was referred to Council but no action was taken. At the Annual General Meeting of 1937 the various Classes held meetings and submitted widely different proposals on this matter, and a special committee was appointed to report to the Autumn Meeting of that year.¹ Since this report was not unanimous regarding special journals in the various Classes, President Morris appointed Drs. Veblen and Swann a special committee to draw up another report to be later submitted to the Committee on Publications.² At the meeting of the last named Committee on February 7, 1938, a report was received from this special committee³ but no action was taken by the Committee on Publications beyond referring the matter to the Society as a whole. At the meeting of the Society on February 18 and 19, 1938, which was devoted to a general consideration of the publication of research, the whole subject of the publications of the Society was discussed by various members from all four Classes. The substance of this discussion is given herewith:

THE PUBLICATION PROGRAM OF THE AMERICAN PHILOSOPHICAL SOCIETY

EDWIN G. CONKLIN: *The Publications of The American Philosophical Society and the Extent of Their Use in Different Fields.*

The TRANSACTIONS is the oldest scientific journal of America, having been started in 1769. Six volumes were issued up to 1809. In 1818 a new series in the present quarto format was started and to date thirty volumes have been issued. It is generally agreed that it serves a very useful purpose for the publication of monographs requiring large plates or charts. Every article is now issued separately without waiting for the completion of a volume. At present six hundred copies are printed in the regular edition and authors are given fifty reprints gratis.

The PROCEEDINGS was started in 1838 and is at present in its seventy-ninth volume. It has from the beginning contained original articles as well as lectures and symposia offered at the meetings of the Society; until the present year it has also contained

¹ YEAR BOOK AMER. PHILOS. SOC. 1937: 49 and 110-112.

² Ibid., 58.

³ See p. 92.

abstracts of the minutes, lists of members, obituaries, etc. At present twelve hundred copies are printed and authors are given one hundred reprints gratis.

The MEMOIRS, started in 1935, is intended for monographs and memoirs of book size. Already nine volumes have been issued and the edition is of six hundred copies. Authors receive fifty copies gratis.

The YEAR BOOK has just been started, the issue for 1937 being the first volume. It will be published annually hereafter and will bring together in one place what has heretofore been scattered through the PROCEEDINGS, which can hereafter be devoted exclusively to scientific and scholarly articles. It is planned to print twelve hundred copies and to distribute them as in the case of the PROCEEDINGS, one copy going to each member of the Society and the others to our exchanges and the trade.

The costs of representative volumes of these publications are approximately as follows:

TRANSACTIONS, edition of 600-1,000	\$2,000 to \$8,000
PROCEEDINGS, edition of 1,200-1,400	\$3,000 to \$6,000
MEMOIRS, edition of 600	\$1,000 to \$2,000
YEAR BOOK, 1937, edition of 1,200	\$2,000

The advertised sales price per volume is

TRANSACTIONS	\$5.00
PROCEEDINGS	3.00
MEMOIRS	\$2.00 to 5.00
YEAR BOOK	1.50

There is no doubt that many economies in publishing these journals could be effected by increasing the number of words on a page and by publishing fewer and less expensive plates and charts. Also expensive tabular material might be reproduced by planograph or other offset process. Possible economies as well as possible improvements in the appearance of our publications should be carefully considered by appropriate committees. Returns from sales might be increased by reducing the number given gratis to members and exchanges, and by wider advertising.

There appears to be general agreement among the members of

the Society that the existing publications should be continued for the purposes they now serve, although there is also the opinion that the character and distribution of these publications could be improved. Since each number of the *TRANSACTIONS* and *MEMOIRS* contains only a single contribution it can be distributed selectively to appropriate institutions and individuals. It has been proposed that the *PROCEEDINGS* be divided into two or three or four separate series corresponding to the Classes of members, thus permitting a more selective distribution. This might interfere with the appropriate publication of certain symposia such as the ones on "The Age of the Earth" or "Factors in American Population Growth" which overlap several Classes. Without formal division of the *PROCEEDINGS* into separate series, it would be possible to segregate related subjects into separate numbers, as is now done in the programs offered at different sessions of our General Meetings, but this would delay publication in cases where few papers are offered in any Class. Certainly the *PROCEEDINGS* should afford means of publishing papers, lectures and symposia that are presented at our meetings and should thus cover as wide a range as our Classes of membership. If more highly specialized and exclusive publications by the Society are needed they should be provided for in some additional series.

A comparison of the number of papers in various fields read at our meetings and later published by the Society is instructive. Such a list for the various meetings of 1937 follows:

January 2. Special Meeting on Viruses and Virus Diseases.

Class II. Pathology. Five papers, all published in *PROCEEDINGS*, Vol. 77, pp. 447-476.

February 19, 20. Joint Meeting on Promotion of Research.

Round Table Discussion and 6 papers, all published in *PROCEEDINGS*, Vol. 77, pp. 561-620.

April 22, 23, 24, Annual General Meeting.

	No. of Papers	Published in Proc.
Class I.	Mathematics 1	1
	Astronomy 2	0
	Physics 7	2
	Chemistry 2	0
Class II.	Paleontology 3	3
	Botany 2	2
	Genetics 2	1
	Zoology 2	1
	Physiology 3	1
	Anthropology 2	2
	Psychology 4	2
Classes III and IV.	History 3	1
	Languages and Literature 2	0
	Art 2	1
	Total 36	15

November 26, 27, Autumn General Meeting.

	No. of Papers	In press or promised
Class I.	Mathematics 1	0
	Astronomy 3	0
	Physics 2	0
	Chemistry 1	0
Class II.	Geography 2	2
	Geology 1	1
	Zoology 2	1
	Physiology 3	0
	Pathology 1	0
	Psychology 1	0
Classes III and IV.	Archaeology 2	0
	Ethnology 1	1
	Economics 1	1
	History 1	0
	Literature 1	0
	Total 23	6

Symposium on the Geophysical Exploration of the Ocean Bottom;
9 papers and Round Table Discussion. All in PROCEEDINGS, Vol. 79,
No. 1.

The number of pages and illustrations in publications of the
Society in 1937, distributed according to subjects, follows:

TRANSACTIONS	Paleontology	625 pp.	76 pls.	
PROCEEDINGS	Physics	115 pp.	0 pls.	
	Geophysics	13 pp.	0 pls.	
	Zoology	184 pp.	19 pls.	
	Anthropology	32 pp.	5 pls.	
	Genetics	75 pp.	0 pls.	
	Botany	123 pp.	10 pls.	
	Physiology	12 pp.	0 pls.	
	Pathology	25 pp.	3 pls.	
	Psychology	27 pp.	0 pls.	
	Archaeology and Ethnology	90 pp.	8 pls.	
MEMOIRS	Ethnology	368 pp.	4 pls.	72 figs.
	Biography	638 pp.	21 pls.	80 figs.
		2,317 pp.	146 pls.	152 figs.

The total number of contributions published by the Society from 1930 to 1937 inclusive and their distribution according to the fields represented by our four Classes of members are as follows:

	PROCEEDINGS	TRANS- ACTIONS	MEMOIRS	By MEMBERS	Non- MEMBERS
Class I.	51	1	1	36	17
Class II.	130	7	1	76	62
Class III.	45	1	1	23	24
Class IV.	29	0	5	18	16
General	9	0	0	7	2
Total	264	9	8	160	121

It is evident from these lists that our meetings are more popular than our publications, or that papers are often read at meetings before they are ready for publication. Furthermore, these lists show that the representation of different Classes in our publications differs greatly. The Classes also differ in the number of distinct fields included and in the number of members in them. On December 31, 1937, the number of members listed in Class I was 131; Class II, 163; Class III, 73; Class IV, 63. The fields are not equally extensive in all Classes and the number of members in Classes III and IV combined is of the same order of magnitude as in each of the other Classes. However, neither programs nor publications are limited exclusively to members.

We have published in our journals more than twice as many papers in Class II as in Class I or in Classes III and IV combined.

Presumably there must be some good reason for this; perhaps opportunities for publishing are much better in the other Classes than in Class II. perhaps members of Class II are more interested in maintaining our publications than are the others, or there may be still other reasons for this disparity. Whatever the cause it is unfortunate that more of the interesting papers that are read at our meetings are not offered for publication in our PROCEEDINGS.

HUGH S. TAYLOR. CLASS I. CHEMISTRY: A cross-section of points of view obtained by discussion of the American Philosophical Society's problem of publication with members of Class I is presented in the following paragraphs, rather than a personal attitude towards the problem in question.

It is quite generally conceded that the reputation, national and international, of a learned society such as ours will depend primarily on the permanent records of work published by the Society. Members disappear, activities in aid of this state, that government, this university, that institution are rapidly forgotten. Only the printed records finally remain. It is generally agreed also that the Society should expend everything that it can afford for the publication of scholarly and scientific work that attains to a high standard of achievement. Upon that effort, in the years to come, we shall be judged in comparison with similar societies here and abroad.

Some support has been expressed for the publication of a general journal of scientific work, coordinating various fields of scientific activity, interpreting newer achievements for the benefit of the membership in general rather than for the specialist. Others have pointed out that while this may lead to a temporary enhancement of reputation, it will be difficult continuously to maintain standards, secure the highest type of contributor and avoid, ultimately, that "popularisation" which is inconsistent with the highest standards of scientific scholarship. Many feel that it is impossible to promote the progress of any major field of science in this fashion.

A sub-committee of the Committee on Publications has reached the conclusion that the best interests of Class I of the Society can be served by the prompt publication of original contributions to the scientific literature, up to 25 pages in length, in the several sciences comprised in Class I. An estimate has been reached

that an outlay of \$5,000 would cover the editorial and printing expenses of such a journal of 500 pages annually. All such contributions should be sponsored by some one of the members, and normally accepted, within the limits of journal size, by the Editor guided however by experience as to the reliability of judgment of the member who communicates the article. There are marked differences of opinion among members as to the degree of editorial supervision which would be required, whether careful consideration by referees, and the resulting delays in publication, are necessary or not.

There is division of opinion, too, on the need for such a special journal in Class I. Brief communications for priority purposes are at present available in mathematics in the *Proceedings of the National Academy of Sciences*, for physics and chemistry in the *Physical Review*, the *Journal of Chemical Physics* and the *Journal of the American Chemical Society*. The astronomers have also a pathway for quick publication of such a type. In physics and in chemistry the large circulation of the journals just named constitutes a severe competitive factor. For this reason, there is a definite group of members who believe that part of the publication funds of the Society might be most usefully expended in contributions for the better publication of research in already established specialised scientific journals.

The attention of members should be directed, in considering the importance of this competitive factor, to the facility with which fashions in publication change, depending on the resources of the journals for publication, as these fluctuate relatively to one another. Thus, in England, within two decades, the important work in physical chemistry left the *Journal of the Chemical Society of London* and gravitated towards the *Proceedings of the Royal Society, Section A*. Congestion recently in this journal coupled with an increase of publication resources by the Faraday Society has caused, in the last few years, a marked drift towards, and a considerable increase in scientific value of the *Transactions of the Faraday Society*. A similar trend away from the *Philosophical Magazine* by physicists has also been noted in the same interval of time. It is within the bounds of probability that the American Philosophical Society could achieve such a diversion of communications towards one of its own publications by a similar, and relatively minor expenditure of its publication resources.

A large measure of support is available for the publication of symposia or groups of papers by experts on a general topic of timely interest. The Faraday Society is an outstanding example of a learned body which has developed the technique of symposia and their publication to a high degree. The contributions, obtained from national and international sources, have made of such symposia valuable definitions of the state of the science. It is felt by many that herein lies the most immediately available avenue for the improvement of the Society's publication work. The value of such symposia is enhanced by their speed of publication and it has been suggested that the Society's efforts in this direction, can be improved if the manuscripts of contributors are required in advance of the meeting, preprinted for the use of those attending the discussion, and subsequently published, together with discussions from the floor, within one or two months of the date of the meeting.

It is evident, finally, that among many members of the section of physical sciences there is a very definite view that the current volumes of the PROCEEDINGS, whatever their merit in the opinion of members of other sections of the Society, fail to reach those high standards of worth and of scientific excellence in the physical sciences to which it must be our constant effort as members of the Society to attain.

W. F. G. SWANN. CLASS I, PHYSICS: I want to commence by pointing out that I am whole heartedly in favor of the principle of synthesis of knowledge; and, I believe that my own attitude has been rather unusual among physicists in the direction of emphasizing the desirability of a worker in one field being as familiar as possible with lines of thought in other fields. I feel strongly, however, that we must guard against deceiving ourselves as to what is possible in this direction and what is not.

Speaking of my own subject, knowledge in modern physics, at any rate, has reached a stage at which, to express anything new and worth while, one must make use of technical terms, mathematical theorems, and processes of philosophical thought which are only the working equipment of the few who specialize. I am perfectly aware of the fact that it is possible to avoid all technical terms in everything, avoid every mathematical symbol, and express what we ordinarily call mathematical equations

in words. However, if this were done the article would be a hundred times as long as it would otherwise be. It would be confusing to the specialist, and so involved to the layman, that I believe nobody would understand it. After all, symbolism and technical procedure are invented for the economization of thought.

In view of the above, and if one is to provide for the general members of the Society, it would seem to become necessary to confine oneself to articles in which technical material was not involved, or was dealt with by analogy, at any rate. In other words, it becomes necessary to descend to the level of the so-called popular article.

Now, I know that it is an ideal and a pleasant thing to contemplate that the members of the American Philosophical Society are all learned men of exceptional mentality, and that they can understand in all fields up to a degree in which it becomes of interest to the specialist to write in those fields. I fear, however, that I must contest this statement, for I believe that in my own subject, it is not until one has passed through the level of popularization represented by a Sigma Xi address down to a level something like that represented by an article in the *Scientific American* that one would reach a form of presentation in which those members of the Society who are not closely connected with the field concerned would get anything at all from the article. I do not mean to say that nobody but an absolute physicist would understand a paper in physics, but I do say that if any article other than that of the type I have visioned were presented in physics, it would be understood in less and less degree as one ramifies out from physicists, through chemists, biologists, anthropologists, to men of affairs; and, it would not be far from the center of ramification that one would find the point where it ceased to be of much value.

I think the solution of the matter is for the American Philosophical Society to recognize fearlessly the above situation, if it is correct, and to provide, in addition to more or less specialized sections, a section or journal which is specifically designed to give men active in one field a knowledge of what is going on in another, and designed, moreover, to fit that degree of general information and ability to understand represented by the average member of the American Philosophical Society. To do this would be to recognize the very laudable desire of the Society to maintain a synthesis of

knowledge, but it would recognize that principle and attempt to provide for it only up to the limit of practicability. It might be a major accomplishment of the Society to extend to the utmost degree the limit of practicability by proper presentation, and so achieve something which has not been achieved by any other organization.

I present herewith the report of the special committee consisting of Drs. Veblen and Swann, which was appointed November 27, 1937:

1. We recommend provision for the printing of a 500 page journal at a cost of \$3,500.00. In addition, there is an estimate of \$1,500.00 for scientific and clerical assistance. The total sum which it is recommended should be appropriated is \$5,000 00 per year.
2. The operation of the journal should be under the control of an editor, to whom a certain sum is allotted from the \$5,000.00 above referred to, and from which he should provide for the necessary clerical assistance and for payments to other persons rendering services in such form as may seem proper to him and to the Committee on Publications of the Society.
3. We recommend that the journal receive contributions which shall be limited to 25 pages, except where special ruling by the editor shall be made to the contrary. While there should be no limitation upon the nature of the material submitted, provided that it is worthy material in the judgment of the editor, the general thought is that papers should embody, in general, results of original research, or should constitute valuable commentaries upon the larger fields embodied in Class I.
4. Each paper would have an inscription such as "Communicated by John Smith, received for publication on October 3, 1937." The person communicating the paper would have to be a member of the American Philosophical Society in Class I. Editors would not be bound to accept papers communicated by members, but it would be their policy to do so within the limits imposed by the size of the journal and their experience of the reliability of the individual member. Immediately on acceptance, each paper should be sent to the printer, and the author would see galley proof, but not, in general, page proof. He should receive 100 free reprints as soon as the

paper has been printed and without waiting for the appearance of the journal itself.

5. The journal should be published monthly, or as frequently as the accumulated material is sufficient for a number, provided, of course, that the restrictions imposed by the budget are faithfully adhered to.

I may say that if you should ask me whether the needs of publication in my own subject are adequately cared for by journals unconnected with the American Philosophical Society, I should unhesitatingly answer, "Yes." The American Physical Society, in collaboration with the Institute of Physics, has given the most careful thought to the matter of publications in physics. The *Physical Review* is, in my judgment, the best journal of physics in the world. The American Physical Society and the Institute of Physics have canvassed with the utmost care all the other avenues of our needs in publication; and one could hardly find a better realization of those needs in the matter of syntheses of fields of physics within itself, and in the matter of general articles correlating recent advances, than is to be found in the *Reviews of Modern Physics*.

It has been stated that Class I desires an entirely separate journal for itself. This does not quite represent the spirit of the situation. The representatives of Class I on the sub-committee would be perfectly content to see the PROCEEDINGS split into sections. It is realized, however, that the desire to retain the PROCEEDINGS as a single volume is so strong that the solution of division into sections is probably impracticable; and, it would, of course, to some extent be meaningless unless all sections concurred in the plan. The spirit of the recommendation of the sub-committee is to the effect that the actions of one section should not in any way form a compelling precedent for those of another. The thought is to the effect that each section would determine whether it desired a special publication.

In my judgment the PROCEEDINGS, or any other journal of the Society, will not attain that importance in the world of science and letters which the Society envisages, and presumably desires, unless it is the kind of thing that will be found upon the library tables of all the important laboratories and institutions of learning in the world. To be of real importance, it must be the kind of thing that people will be willing to buy, and will have to buy.

I know that many of us adhere to the belief that it is possible to have in a journal of the type of the PROCEEDINGS articles which are worthy contributions to knowledge and represent varied fields. This certainly has not been true in the past. I suggest that the members of this meeting search their own minds and decide whether they have read one paper in the PROCEEDINGS during the last ten years. I think a census of the results would be illuminating.

I admit that it is possible to publish articles which, while of a general nature, are dignified, constructive, and useful; but I maintain that, for the most part, such articles do not represent original contributions to the advancement of science in the sense in which that term is understood. One does not find among them the landmarks which have marked the growth of knowledge. If this be doubted, I will ask any physicist to consider some article which, in its character as regards a new development, was just a little below that which he would wish to publish as an original contribution to science. Then I state that in the majority of cases this article, which falls short of newness of content as a representative of original research, will still be many laps ahead, as regards significance and readability, of what the average member of the Society, who is not a specialist in the field, would comprehend. This, in my judgment, is the real test.

In conclusion, it is, in my judgment, impracticable to have the PROCEEDINGS in anything like their present form serve the purposes of publishing original research of the type referred to in the field of Class I. If the Society commits itself to the policy of not concerning itself with such publication, then that attitude is understandable. If it *does* wish to participate in this form of publication, the only way in which I see that it could do so successfully is by some such procedure as that recommended in the report. In adopting this procedure, one is going very definitely into competition with other journals doing the same thing and doing it well, and one is doing this, in the first instance, primarily for the prestige of the Society. The fact that the Society can publish without any reimbursement from the authors should be a point in helping to secure good material. In the long run, I believe that the creation of a more active spirit for participation of the Society in research projects through publication will not only redound to the glory of

the Society, but will make it a more potent and valuable influence in the scientific world as a whole.

HENRY NORRIS RUSSELL. CLASS I, ASTRONOMY: This very interesting discussion has brought out clearly the main publication problems of the Society. Classes II, III, and IV have evidently no need for an additional journal. Speaking as an individual member of Class I, I may say that I am very far from being convinced that there is any need that, in this field, the Society should publish a journal containing numerous short articles as suggested by the sub-committee. In the physical sciences, an abundance of excellent periodicals are already in existence—in astronomy, the *Astrophysical Journal*, *Astronomical Journal*; in physics, the *Physical Review*,—which appears fortnightly, and contains over 2,000 pages a year; in chemistry, the still larger *Journal of the American Chemical Society*, and the *Journal of Physical Chemistry*,—not to mention smaller journals which publish good material. There is at times a need for rapid publication of advance accounts of new investigations, both to secure priority, and for the worthier purpose of letting others who are working in the field know what is being done, and avoiding duplication. In physics, this is met by letters to the editor of the *Physical Review* (up to 300 words long) which are very quickly published; in chemistry, by similar letters to the journals already mentioned. In astronomy, discoveries, for example, of comets, are telegraphed to Harvard, where it is reported by telegraph to observatories which care to pay the cost, and much more widely by post-card. The printed post-card is certainly the quickest and cheapest method of spreading scientific information, and dozens are put out yearly.

A theoretical result in astrophysics could be sent in a letter to the *Physical Review*, to *Nature*, or to *Science*,—an excellent medium of publication—which I think Dr. Cattell will agree with me in wishing were more used by physical scientists.

In mathematics this rapid publication often occurs in the *Proceedings of the National Academy*, where they fill a considerable space. Despite my limited knowledge, I often realize that these papers are so condensed that the student who desires a full critical knowledge of the new theorems must wait for a fuller publication.

If our mathematical friends feel the need of better facilities for early publication, I maintain that the responsibility is up to them, and not to the Philosophical Society.

I see another—and a serious—difficulty in the proposal. The existing specialized journals have competent—and wary—editorial staffs, who can detect papers of dubious value, and submit them to referees specially competent to appraise them. The single editor proposed for our new publication could not possibly be versed in the many disciplines comprised in Class I, and some sort of an advisory committee would have to aid him in picking out referees, for papers quite outside his own field. Without this, the high quality which every speaker has agreed is essential could not be maintained; but it would be hard to work in practice. The Royal Society has so many Fellows living near London that its Committee on Papers can meet frequently, and consider every paper offered; but the membership of our Society is scattered widely, and papers must necessarily be discussed and refereed by correspondence. This takes so much time that rapidity of publication is almost inconsistent with a high standard of quality.

I see no good reason, therefore, why our Society should enter into competition with the excellent existing journals, which publish short papers, by establishing one more—and very good reasons why we should not.

I am in hearty sympathy, however, with the view, expressed by Dr. Leland and other speakers, that we will do well to publish longer papers of real value, which the current journals can only do if the author finds a way of meeting most of the expense, and not always even then. Such publications in astronomy are often financed by subscription at a definite price—one on the spectrum of Nova Herculis is now in course of preparation. There must be many such cases, in all our Classes, in which the aid of the Society would be of great value.

ALBERT F. BLAKESLEE. CLASS II, BOTANY: The publication problem cannot be adequately discussed without taking into consideration the points of view of the editors, contributors to journals, libraries, organizations supporting publications, and the more or less patient and gentle reader.

Viewpoints of Editors. A form letter was sent to editors of the leading biological and geological journals of this country requesting information regarding what they thought were the greatest publication problems in their fields with suggestions for their solution. It was stated that the question might arise as to whether

the American Philosophical Society should establish a new journal for biology and geology. A total of thirty-four replies was received for biological journals and six for geological journals. The number and character of the responses left no doubt that as a group editors believe the publication problem is a serious one. The geologists were unanimous against a new journal in their field, and of the biologists sixteen wrote against a new journal and four seemed to think a new biological journal might be useful. It is difficult to score replies numerically since a questionnaire with specific questions was not submitted. The figures, however, will give some idea of what editors consider their leading problems. The replies from biologists will be considered first.

Only six seemed to have no publication problems. Ten suggested that rather than starting a new journal the existing journals should be strengthened and enlarged. It was felt that journals could print a considerable number of additional pages each year without the editorial set-up feeling the load appreciably. A couple suggested that merging some of the present journals would be of advantage. Thirteen stressed the need for means of publishing longer articles of monographic character. Of these, two suggested that such monographs could most economically be published as supplements to existing journals. The opinion was expressed that there is more need for additional outlets for publications on taxonomic problems than on experimental work. A half dozen lamented the lag which in some cases amounted to over a year between receipt of manuscripts and their publication. The pressure of manuscripts has been met in part by setting a limit to the length of articles and the amount of tabular and illustrative material printed without charge to the author and in part by rejection or condensation of poorly written manuscripts. Five stress the need of more editorial supervision of manuscripts before acceptance. One suggests a clearing house among editors to prevent a poor manuscript from being published elsewhere without revision after it has been rejected by a careful editorial board of another journal. These letters and reports from publishers indicate that for some reason there is a slight slump in the number of manuscripts now being sent into journals. In consequence, in many cases the pressure on journals is less than it has been in the past or than it appears likely to be in the future.

The need of subsidies or endowments was mentioned by four,

and in addition three urged that part of the funds allotted for research should be earmarked for the publication of such research. It was of interest to note, however, that a larger number discussed methods of solving their own problems internally rather than seeking outside financial support.

Reference was made more than once to what had been accomplished by the recent reorganization of the *American Journal of Botany*.¹ One editor reported that by change of format his journal was publishing 40 per cent more material in the same number of pages without a corresponding increase in cost. In contrast a second editor wrote that from the point of view of his board "the American Philosophical Society could not expend its funds more wisely than by subsidizing such existing agencies as the "—Press." It happens that the journals of this press were criticized by the first editor just mentioned as not having an economic format. The fact that on a cost per page or a cost per word basis their publications stand out as conspicuously high among American journals (more than 50 per cent higher than cost per word of 5 standard journals taken at random) would suggest that a subsidy from the American Philosophical Society, before the possibility had been studied of lowering costs through changes in organization, would be a disservice to the publication problem.

One editor suggested that if any subsidy be granted to journals it should be in the form of additional subscriptions sent gratis to strategic libraries and laboratories abroad. Such a scheme would assist in the dissemination of useful knowledge at the same time that it helped the finances of the journals involved.

One stated that it is the scientific societies which should consider the problems of adequate publication and that privately managed journals should be discouraged. On the other hand, another editor pointed out the disadvantage of having society journals which limit articles to their own members, since they are not freely open to foreign authors. The same editor pointed out that whereas there are many outlets for factual papers there are only a limited number for reviews and general discussion. There is a feeling abroad that the amount of digestion and criticism in our country does not keep pace with the accumulation of data.

¹ "Report of the Committee on the *American Journal of Botany*," adopted by the Botanical Society of America at its thirtieth annual meeting. *Amer. Jour. Botany*, 23: 80-82, Jan. 1936.

The short durability of the pulp paper used by journals today is of concern to some editors. The University of California is reported to be meeting the problem by using the best rag paper for 25 copies of its publications which are deposited in special libraries over the world.

Aside from matters immediately related to their own journals considerable appreciation of the need of abstracting agencies was felt by editors. Nine specifically mentioned the problem of *Biological Abstracts*.

The replies from geologists show much the same publication problems as those from biologists. Despite the Penrose Fund, which has enabled the Geological Society of America to enlarge its own journals and to subsidize a number of other geological journals, need is felt for outlets for longer articles. Editorial supervision to insure adequate condensation is stressed. The suggestion is made that if publication support be given from the outside it would be better to assist in the publication of manuscripts in the regular channel to which they would ordinarily go, with a statement giving credit for the source of support.

It has been possible to give only an outline of the main suggestions made by editors of biological and geological journals. There is general agreement as to the importance of careful study of publication problems.

Viewpoints of Contributors. As a basis of a discussion of the needs of those who submit manuscripts to journals, a tabulation was made of the publications (exclusive of books) of the seven investigators who have been members of the Department of Genetics, Carnegie Institution of Washington, for the ten-year period ending July 1, 1937. During this time they published (exclusive of abstracts) 328 articles, averaging 10.5 pages, in 96 different places of publication. From the tabulations and discussion with the individual investigators, it is clear that while many factors may influence the place to which a manuscript is submitted, two are of especial importance, namely, speed of publication, and effective distribution among those likely to be interested in the particular research. Speed of publication (well within 2 months from submission of manuscript) is probably responsible for the *Proceedings of the National Academy of Sciences*, with 34 papers, being one of the journals most frequently patronized by our group. Relative

slowness of publication (around a year for the present paper and a previous one by the writer) and the character of its distribution were probably in part responsible for the PROCEEDINGS OF THE AMERICAN PHILOSOPHICAL SOCIETY having only six papers from our group. The publication facilities of the Carnegie Institution are naturally available to investigators in its Department of Genetics, yet they have been used only four times during this 10-year period, with a total 253 pages. This is due in part to the fact that most of the papers from our group are relatively short and not adapted to the Carnegie Monograph series, and in part to the fact that papers published by our institution or in the memoirs or transactions of academies have poor distribution among specialists in our line of work. We find it more profitable therefore to publish phases of our research as they become ready in short articles in journals that give prompt publication and which reach a wider circle of our colleagues. Of course certain journals are avoided on account of unfavorable policies such as charging the author for tabular matter, and other journals are favored for special reasons. Thus the *Journal of Heredity* which features illustrations has been used considerably by our group when extensive illustrations seemed desirable.

Viewpoints of Libraries. Libraries are intimately involved in the publication problem since their subscriptions help support journals.

Preliminary tabulations have been made of the cost per page for the journals in the library of the Department of Genetics. When checked by cost per word they give valuable information. An extreme example may be given. In 1937 the *American Journal of Botany* published 751 pages at a subscription cost of \$8.00 per volume. This is at the rate of around 1 cent per 1,000 words. A certain German journal published 1,616 pages in 1937 at a subscription cost to us of \$78 or 4.8 cents per page. This is of the order of 9 cents per 1,000 words, or approximately 9 times the cost of the American journal. If the cost of the German publication per 1,000 words had been at the same rate as that of the *American Journal of Botany* it would have cost us \$8.66 instead of \$78.00, and we should have had about \$69.00 released with which to purchase other journals.

We subscribe to two English language abstract journals. One costs about 1 cent per 1,000 words. The other, *Biological Ab-*

stracts, costs less than a half cent per 1,000 words. If the charge for the latter were on the same basis as the first, the subscription price for *Biological Abstracts* would be around \$37.00.

The library at the Department of Genetics is an example of a working library of current and recent publications. With a fixed annual budget of \$1,800 for purchase of books and journals it is possible to subscribe for the journals most needed by our staff. Through the inter-library loan system it is possible to secure loans from other libraries within a day or two. Within the past year 51 volumes were borrowed on inter-library loan. The Bibliofilm Service has also been utilized for material not otherwise available. By these two methods, cited literature can be readily secured. For keeping track of the current literature, however, the most valuable part of the life of a journal is the week during which it is laid out on the library table. During the year 413 books were charged out, but this figure does not represent the daily use made of the library.

The library of the American Philosophical Society is in contrast to the one just discussed. For 1937 it had a budget appropriation of \$24,400. In addition there was \$7,643 from special funds, such as the Michaux Fund which had originally been given for general purposes but which had been more recently assigned for purchase of books. There was thus a total of \$32,043 available for the library in 1937 including salaries and rental of library rooms. During 1937 there were, exclusive of about 50 who might be called museum visitors, about 150 who consulted the library. The number of visitors and the size of the library budget indicate that the Society has a problem as to the most effective use of its library. It would be unwarranted without further study, however, to conclude that the Society pays out annually over \$200 for each of the 150 who consult the library and hence it could better afford to pay their expenses in visits to other library centers. The Franklin papers, and other early Americana, of which the library has a priceless collection, were the documents most largely consulted. The library appears to be used primarily because of its source material and not much for the readily available current literature. There were last year 6 borrowings from other libraries and 45 loans made to 15 libraries. In addition a considerable service is rendered by the library staff in research and correspondence in reply to inquiries from all parts of the world. A considerable number of the journals

received are through exchanges for the society's publications. The information just given was kindly furnished by the librarian.

The two libraries described have different opportunities for service. So far as use is concerned, it would appear unprofitable for the library of the Department of Genetics to spend funds for rare manuscripts and equally unprofitable for the American Philosophical Society to put its funds into current literature which is readily accessible elsewhere.

Publication Program of the American Philosophical Society. The adjoining table gives data regarding the Society's publications. For 1937, \$25,000 was available in the budget for publications but only \$16,528 used. The PROCEEDINGS goes to all members and the other publications to those members who request certain issues. The "Miscellanea" are not included in the table since there were no publications in this series in 1937. Publication of papers in any of the series is open to non-members if sponsored by a member.

Recommendations. As representative of Class II (Geological and Biological Sciences) I am suggesting the following recommendations:

1. That the American Philosophical Society consider assuming leadership in a continuing study of the problem of dissemination of useful knowledge broadly considered (a) in relation to the service which it can render to its members and (b) to the fields of knowledge which they represent.

2. That the Society consider engaging for such study a salaried officer who would function as a research professor or with possibly the title of coordinator of publications. This suggestion is made with the belief that the problem is too large and important to be left solely to part-time interest and study of committees. We agree with Dr. Weaver's remark at last year's symposium that so far as results are concerned it does not pay to be too economical with overhead. In memory of our founder we might establish the Benjamin Franklin Research Professorship of Publications.

3. That the Society consider changing to a more economical format for its publications and to this end consider for all its publications, including MEMOIRS and TRANSACTIONS, for the format and methods of manufacturing journals used by the American Physical Society and the Botanical Society of America. Experience has shown that careful study of all aspects of a journal's expenditures

may effect a saving of from 25 to 50 per cent. Economy in illustrations has been discussed in the previous day's program. As an example of where a possible saving might be made may be mentioned a recent issue of the TRANSACTIONS in which what appeared to be charcoal drawings of fossils were reproduced by the expensive gelatine process. Biologists complain that geologists demand larger reproductions than are necessary, and a recent questionnaire which was circulated among geologists indicates that excessive cost of illustrations is of concern to editors of geological journals.

4. That a careful census be made regarding (a) the extent to which the collections in the Hall of the Society and in the Library are actually being used in the promotion of knowledge, and (b) possible means by which they might be made of greater service.

That in doing this, three services which the Society can render be considered separately: a. Museum uses. b. Manuscripts, especially Frankliniana, early Americana and rare publications not obtainable or with difficulty obtainable elsewhere in this country. c. Publications readily obtainable elsewhere.

5. That, if it is found that the publications readily obtainable elsewhere are not paying dividends in actual use or cannot be made to render an adequate service in the dissemination of knowledge, they be disposed of by sale or gift to some other library, preferably in the Philadelphia area, where they will render a greater service.

6. That the value of exchanges be studied with the purpose of securing the most effective distribution of the Society's publications to those intellectual workers of the world who are carrying on studies in similar fields.

7. That, if this study discloses more effective means of disseminating knowledge, the Society's exchanges be discontinued in whole or in part.

8. That consideration be given to the feasibility of the Society publishing as regular articles or as supplements in already established technical journals such longer articles as have difficulty in finding other sources of publication, in such a plan the Society bearing the entire cost of publication or for the shorter articles the cost above the limit of pages allowed in the particular journals involved.

9. That, if a plan of cooperation with existing journals be adopted, consideration be given to the following conditions: that

the Society utilize for its publication only such journals as satisfy requirements imposed by the Society regarding circulation, adequate editorial supervision to insure economy in condensation of text where necessary, and economy of tabular matter and illustration, etc., as well as economy and efficiency in business management and manufacture of the journal. The suggestion of a manuscript for publication under this scheme might be taken up with an accredited journal either by the American Philosophical Society or by the editor of such journal who has a manuscript which his editorial board can recommend but for which space is not available. In any case full editorial supervision should be given by the editorial board of any journal publishing for the American Philosophical Society and the paper should be listed as a publication of the American Philosophical Society and reprints be available at cost. Such a scheme would enable the experience and advice of the Society's research professor of publications to be passed on to editors and would have a similar beneficent effect upon the standards of journals, we believe, that Abraham Flexner's report had upon standards in medicine.

10. That consideration be given to making such publication in established journals a substitute or, by means of reprints, a supplement to the present method of distribution by exchanges.

11. That a study be made of the most effective use for the dissemination of knowledge that can be made of the income from the Michaux Fund and other special funds now used for purchase of books for the library with the possibility of their utilization in a more effective dissemination of the publications of the Society.

12. That the formation be considered of an association of editors, printers, and others concerned with publication with possibility of an occasional international congress on publication problems.

13. That before any action be taken by the Society regarding suggestions made at this meeting a thorough study be made of the relative dividends in the dissemination of useful knowledge which their carrying out would bring to the Society and to the fields which they represent; that the motto of the Society should be "*Information before Legislation.*"

PUBLICATIONS OF AMERICAN PHILOSOPHICAL SOCIETY

	PROCEEDINGS	TRANSACTIONS	MEMOIRS
Edition	1200-1240	600-660	682 Vol. 6
	(Before the issuance of No. 1, Vol. 78, 1400-1440 were pub- lished)		671 Vol. 7 682 Vol. 8
Exchange List	Approx. 700	Approx. 300	Approx. 300
Number in	Vol. 78 No. 1 86	Over 300	Vol. 6 Over 300
reserve	Vol. 77 about 200		Vol. 7 Over 300 Vol. 8 Over 300

NUMBER OF CONTRIBUTIONS

Class I			
(Math. and Phys. Sciences) ..	51	1	1
Class II			
(Geol. and Biol. Sciences) ..	130	7	1
Class III			
(Soc. Sciences)	45	1	1
Class IV			
(Humanities)	29	-	5
General	9	-	-
No. words counted on sample			
page, 3-yr. average	352	632	354
1935, no. pages	807	1,725	1,035
1936, no. pages	988	308	162
1937, no. pages	1,064	633	1,285
1935—Cost	\$3,890.45	\$0,938.79	\$4,483.92
1936—Cost	4,985.56	3,919.25	1,109.77
1937—Cost	6,312.10	5,965.79	4,250.01

ERNEST MINOR PATTERSON. CLASS III, ECONOMICS AND STATISTICS: It has not been possible in the short time at my disposal to assemble the opinions of other members of the Social Science Division, although I have talked with a number of them as I had opportunity. So nearly as possible, my suggestions are a reflection of what I understand to be their general view.

There should be a recognition of the fact that our various scientific bodies exist for different purposes. It is my own thought that the American Philosophical Society can best function in the field of advanced scholarship, leaving to other organizations some of the other highly important fields of service. I shall not be disturbed if the meetings of the Society and its publications do not make a wide popular appeal. An attempt to pass from the field of ad-

vanced scholarship in which I think we can function best would result in an unfortunate duplication of effort. Moreover, I doubt whether such an organization as the Society is equipped or should be equipped to make a wide popular appeal.

If this idea is applied to the field of publication, it means in the field of social science several things. First is the recognition of the existence in that field of a very large number of journals, as, for example, in economics, with which I am most familiar,—the *American Economic Review*, the *Quarterly Journal of Economics*, the *Journal of the Sociological Society*, the *Journal of Political Economy*, the *Harvard Business Review*, the *Journal of Business of the University of Chicago*, and many others, both in the United States and abroad. There seem to be adequate outlets for specialized articles in economics and some of my associates in other aspects of social science tell me that the same is true for them.

There has been suggested the possibility of a new journal which would undertake what may be called the work of synthesis in the field of social science. To this proposal two replies have been made. One is that there is only a limited need for such work and the other is that there is already one journal, *i.e.*, the *Journal of Social Philosophy*, which is undertaking to do this. In view of the limited demand for such a publication, it would seem better to leave the field to the *Journal of Social Philosophy*.

If we conclude that there is not a suitable place for a new journal in the Social Science field, to be published by the American Philosophical Society, there is left for consideration what publication work should be undertaken in this field. I am most strongly impressed by the need for the publication of studies longer than ordinary articles. Some of these would be merely good-sized pamphlets, while others would be large monographs or perhaps even works of several volumes in length. Most of them would have a quite limited circulation and would not appeal to commercial publishers. Specific illustrations have been furnished me from the field of history and political science.

EDWARD S. CORWIN. CLASS III, JURISPRUDENCE: I wish to urge publication of a Library of American Political Thought, to embody such portions of the published works of famous Americans as are of theoretical interest and may be said to constitute the American political and constitutional tradition, since they have gone to

determine the form of our institutions. Today this material lies buried in voluminous compilations of letters and other writings, which are designed for the use of biographers and historians. If the American tradition is not to be lost for the generality of reading Americans it must be rescued from this inaccessibility. Among the famous Americans thought of in this connection are Washington, Franklin, the Adamses, Hamilton, James Wilson, Webster, Calhoun, Marshall, Taney, Jefferson Davis, Lincoln, James Russell Lowell, Elihu Root, Woodrow Wilson, Theodore Roosevelt, and others. There should also be volumes to include relevant portions of pamphlet material, extracts from debates in state constitutional conventions, and probably some other sources. When all sorts of ideas of alien origin are today being constantly thrust upon the attention of American readers, the American tradition should be available on reasonable terms; and what institution can more legitimately concern itself with the problem of rendering it available than the American Philosophical Society, which has itself contributed so much to the development of this tradition? And could one imagine a more appropriate time for launching such a project than these years of commemoration of the establishment of the Constitution? A recent writer has said: "I would say that a nation exists where there is a sense of participation in a common spiritual heritage, and a will to improve that heritage for the benefit of those to whom it shall be in turn passed on."¹ There can be no reasonable doubt of the sufficiency of the American tradition, renewed and improved, for the problems which today confront us as a nation. But the processes of renewal and improvement must work upon minds which have some knowledge of this tradition to begin with.

WILLIAM E. LINGELBACH. CLASS III, MODERN HISTORY: I agree with Dr. Conklin that the quality of PROCEEDINGS has in recent years been excellent in certain fields. On the other hand, I am also in agreement with Dr. Taylor that if the PROCEEDINGS are to occupy the place among scholarly publications he has just described, something radical must be done to improve the quality of the articles from all four Classes. To bring this about will require much closer cooperation between the Committee on Meetings and the Committee on Publications than heretofore. Since the Pro-

¹ Albert Jay Nock, *Free Speech and Plain Language*, p. 102.

CEEDINGS are devoted in part to the papers read before the Society, they necessarily reflect the time and effort devoted to systematic program-making. Careful and constructive planning of programs by the Classes is therefore imperative. For this, as well as for other reasons, the Committee on Meetings should be organized and financed to go at the job scientifically. It should see to it that in addition to the usual papers by Society members, or by recipients of grants for research, there be presented more or less periodically for the different fields, review articles of the literature and the progress of research; symposia on the live issues or trends; and more frequently than hitherto, papers by invitation of non-member scholars on their special subjects.

The TRANSACTIONS seem to me admirably fitted, as Dr. Leland suggested, to take care of the kind of studies which lie between the larger article and the printed volume; the type of manuscript for which it is generally most difficult to find publication. If this were definitely kept in mind, our TRANSACTIONS might conceivably acquire a unique distinction and character.

The MEMOIRS which are devoted to individual volumes of substantial size, could be made extremely significant if a somewhat different method of selection of manuscripts were adopted. Naturally only works of quite outstanding merit should find a place in the series. The problem is how to attract work of this character. Two things should in the long run help, first the reputation of the Society, and second, the funds at the disposal of the Committee on Publications. A third, which could be developed, lies in the direction of closer cooperation with the scientific societies and associations from which our own membership is drawn. To illustrate what I have in mind, may I describe the procedure developed by our American Council of Learned Societies which is represented in the American Philosophical Society by the humanities (Class IV). The Council has a Revolving Publication Fund of about \$40,000 for subventions to publication. Each of the twenty constituent societies that make up the Council invite scholars of their group to submit manuscripts. From these a special committee selects the ones it considers the most meritorious, and sends them with its endorsement and comments to the Secretariat of the Council of Learned Societies. There the recommendations and manuscripts are coordinated with those submitted by the other constituent societies and placed before the Council's Jury of Awards

for final judgment. The Jury of Awards in turn selects what it regards as the best of the works, and recommends subventions for their publication from its Publication Fund. The subventions may vary from \$100 to \$1,000 or more, but do not, as a rule, cover the entire cost of publication. Now, since the Council's funds are very limited, it would welcome the opportunity occasionally, or annually, if desirable, to refer one or two exceptionally good and representative manuscripts in the humanities to the Committee on Publications of the American Philosophical Society for its consideration and publication. The Society could then rest assured that in the humanities at least it had manuscripts of outstanding quality, work that had survived two critical examinations conducted by the scholars in the field in which the work lay. It would not necessarily interfere with *ad hoc* offerings, but it would subject them also to wholesome competition. If similar cooperation could be established with the other three Classes, the MEMOIRS might reasonably be expected in the not distant future to represent some of the best research and writing of American scholarship.

As to the fields of interest to which the Society might suitably give special attention in building up its MEMOIRS series, I am, of course, especially concerned with Classes III and IV. For these it seems to me obvious that we should favor works relating to early American history, economics and politics, particularly if they are in some way related to distinguished members of the Society itself. Much of President Jefferson's work, for example, is not only unpublished, but not even calendared. The Society might very properly let it be understood that it stood ready to help in the publication of scholarly work in that direction. Indeed the papers of other Presidents of the United States might be worthwhile. Those of President Harrison are at present being edited by Professor A. T. Volwiler of the University of Ohio, who was entrusted by the Harrison heirs some years ago to examine and study the papers. One volume containing the spirited Harrison-Blaine correspondence is ready and will, I believe, be submitted to the Society for publication. It has been supported by a grant from our Penrose Fund.

Equally worthwhile from the Society's standpoint, would be a more complete edition of Franklin's writings. Professor Crane of the University of Michigan told me recently that he had copies of anonymous articles by Franklin, mostly heretofore unidentified, sufficient to make an entire volume.

Another example of the kind of publication that would bring distinction to our publications and to the Society is illustrated by the *Linguistic Atlas of the United States*, a work which concerns several of the disciplines in Classes III and IV. It is an undertaking by the American Council of Learned Societies. The work for the New England area is done. Ultimately, it will cover the entire United States. The Prospectus for the publication of Part I is ready. Publication will be expensive and naturally there must be assistance beyond the funds which the Council can supply. The subscriptions will carry it in the long run but in the initial stages the American Philosophical Society could render real service by a guarantee against a possible though very unlikely deficit.

Professor Corwin's proposal for a History of American Political Thought appeals to all of us, but the plan carries with it a suggestion to finance the preparation of the different volumes and therefore raises quite a new problem, a problem that concerns first of all the Committee on Research.

In conclusion, I want for a moment to return to the PROCEEDINGS and the possibility of their improvement through symposia at our meetings. Dr. Conklin has referred to the value of the one on the "Geophysical Exploration of the Ocean Bottom." The results of a similar program on "Approaches to American Social History" at the Providence meeting of the American Historical Society I have just published under that title as a volume in an Historical Essays Series. The *Annals* of the American Academy of Political and Social Science is built up almost entirely on this editorial policy. There is a real need for surveys of this sort of the research and publication in the different fields of learning provided the studies are well integrated and done with a lively sense for that broader synthesis which is still so largely absent in much of our research. That this will require expert editorial direction is evident, and I believe it would be wise to have an editor for each Class with a modest salary, whose duties would involve, not merely the editing of manuscripts submitted for publication, but also the securing of articles, and active cooperation in program-making for the Annual Meeting.

WALDO G. LELAND. CLASS IV, HUMANITIES: The American Philosophical Society is in search of a sound policy with respect to publication. It has funds, and it can command the services of

scholarship; it has only to decide upon the course that will be most appropriate to its objective: the promotion of useful knowledge.

I have no mandate from my fellow members of Class IV to speak for them or for the humanities, so whatever I may propose is put forth on my own responsibility.

In the first place, it may be well to consider the courses that we should not follow. We should not attempt to do what is already sufficiently done by other agencies. We should not, accordingly, enter upon the publication of any specialized journal or review. Those who propose to start new journals have a heavy burden of proof to justify the proposed expenditures of time, effort, and money. In the first place, they must show that they fully represent the general body of specialists in their particular field. In the second place, they must prove that the body of specialists interested in the venture is large enough to support the proposed journal, financially by subscriptions and scientifically by contributions of articles and reviews of a high order. In the third place, they must prove that existing journals cannot meet their needs.

We should not enter the field of general scholarly publication by setting up a new agency or service. There are already too many university presses in the United States, and their combined overhead is an increasing burden.

We should not, merely because we have the necessary funds, encourage publication in unnecessarily sumptuous forms, by means of subventions.

We should not build up a stock of publications for which there is no scholarly demand, and which will accumulate dirt and expenses of storage and insurance and eventually have to be destroyed to make room for more of the same.

What, then, should we do?

We should, first of all, publish the record of our own activities through the medium of the PROCEEDINGS and the new YEAR BOOK. We owe that to ourselves and to the history of our Society.

We should seek out the conspicuous gaps in existing publication facilities. So far as the humanities are concerned—and I believe that the same is true of other fields—such a gap exists between the journal and the conventional volume of three hundred or more pages. Our MEMOIRS might usefully help to bridge that gap by providing a medium for the writing that is too long for publication in a journal and too short to be treated as a full-sized book—that is,

for the long article or short monograph, ranging from forty or fifty to a hundred and fifty or two hundred pages in length. Such writings, published in our series of MEMOIRS, would each be a unit in itself for distribution to those to whom it might be useful, but in the aggregate they would constitute a series of numbered units, suitable for library treatment as a whole. This assures to the separate units a sort of immortality that they might not otherwise enjoy and insures them against falling into the categories of ephemeral publications.

As to the nature of those contributions published as MEMOIRS, the comprehensive composition of our Society suggests the appropriateness of seeking works that are of value or interest to a considerable range of scholarship. I do not mean that the more specialized writings should be excluded, but rather that a special effort should be made to include writings of synthesis, of generalization, or of summarization; as, for example, a not too technical statement of the present state of our knowledge of American native languages, presented in such a manner as to be intelligible and interesting to non-linguists and to suggest relationships with other fields of study. Such publications would extend the service that our meetings perform in explaining ourselves and our special interests to each other, and enable us more easily to appreciate our community of interest.

If we continue, as may be assumed, the publication of the TRANSACTIONS, they will doubtless, as in the past, be reserved for sizeable works of importance, requiring and deserving special treatment and, usually, supplemented by illustrative material. Here, it seems to me, our only criteria are the excellence of the work in question and the importance of its contribution to knowledge. We should endeavor to make the TRANSACTIONS representative of the best work by American scholars in all fields of learning.

Thus far I have discussed only the established series. Should we create others, or should we extend assistance to the publication of works that do not fall within the scope of our existing categories? The latter course seems to me preferable; the Society should assist publication by modest subventions in somewhat the same manner as it assists research.

This naturally raises the question as to what sort of publication should be assisted. Here, again, we should endeavor to meet clearly recognized needs, and, so far as the humanities are concerned, one of the greatest of such needs is that of assistance to

the publication of essential tools of research: bibliographies, dictionaries, corpora, etc. In giving such aid, the Society should not enter into burdensome alliances, nor should it make long-term commitments; but modest grants in aid of publication, if awarded with discretion and discernment, can perform useful services out of all proportion to their amounts. By way of illustration, indicating the variety of publications that might be aided, let me mention a few that have been assisted by the American Council of Learned Societies. These include the Corpus of Ancient Vases in American possession; the Census of Fifteenth Century Books in American libraries; the Census of Medieval and Renaissance Manuscripts in the United States and Canada; the Census of Indic Manuscripts in the United States; and the Catalogue of Alchemical Manuscripts in American collections. Such inventorying of the materials for scholarly research in the United States is an indispensable aid to scholars, and constitutes an obligation to the scholarship of the entire world, for much of our most valuable resources has come to us from other countries.

In making grants in aid of publication, the Society could also exercise a wholesome influence. It would, of course, insist upon the highest possible standards of scholarship; it would—though this is not so easy—insist upon the relative importance of works to be aided and upon their significance beyond their special subjects or fields; it could also insist that the method of publication should be selected with due consideration to the probable use and distribution of the work in question. This insistence alone would be an important step toward the solution of what we call the “publication problem.”

By way of summarizing my proposals, let me present them in the following manner:

1. The YEAR BOOK would be devoted to all the organizational business of the Society, and the PROCEEDINGS would contain the records of its meetings.

2. The MEMOIRS would be reserved chiefly for writings of 50–200 pages that are too long for publication in the learned journals and too short to be published advantageously as books of conventional format and size. An effort would be made to attract works of synthesis, without, however, excluding specialized contributions.

3. The TRANSACTIONS would be reserved for works of unusual distinction, presented in attractive and impressive form.

4. Grants in aid of publication would be made, with especial attention to tools of research.

Such a program is flexible and simple; it does not enter into competition with the publishing activities of universities, commercial firms, or other societies. It does not include activities that are inappropriate for a Society like ours to undertake, but endeavors to meet some of the needs of scholarship which other agencies find it difficult or impossible to satisfy. It would enhance the prestige of the Society and extend its influence for promoting useful knowledge.

SUMMARY OF DISCUSSION

EDWIN G. CONKLIN.

The results of this discussion serve to show that it is not generally considered advisable at this time to undertake the publication of specialized journals in the many fields represented by membership in the Society. To do this would not only involve large expenditures but it would invade fields already well occupied by specialized journals and it would be a departure from the time-honored purposes and character of this Society. Apart from its historic background the distinctive character of this Society is its inclusion of all fields of learning and many members say that this is one of its peculiar charms. They add that they like to hear papers presented by scholars in fields other than their own, and many contributors to our programs and publications say that they find it profitable and stimulating to attempt to make plain to scholars generally the results of their special researches. It is generally agreed that the programs at our meetings are usually of a high order of excellence in both substance and method of presentation and it seems to many members of the Society that the publication of such papers and symposia serves a useful purpose.

At the same time the increasing number of large monographs which are offered for publication in the PROCEEDINGS, TRANSACTIONS and MEMOIRS indicates that the Society is meeting a real need in this direction. These monographs are usually issued as separate publications and can be distributed selectively to institutions and scholars in the special fields concerned. Lists of such institutions and scholars in various fields should be carefully prepared and frequently revised.

In the discussion of our publication program on February 18 and 19, 1938, several persons indicated that important savings

could be effected without reducing the value of our publications. All such proposals should be carefully investigated by a special committee chosen with reference to its acquaintance with the publication business. It is suggested that such a special committee be appointed with instructions to report to the Committee on Publications for ultimate reference of this subject to the Society.

The Committee held six meetings during the year, namely on February 4, April 4, May 2, June 8, October 10, December 12. It accepted for publication in the

PROCEEDINGS	53 papers
TRANSACTIONS	2 monographs
MEMOIRS	2 monographs

During the year the following papers were published:

TRANSACTIONS:

Volume XXIX, Pt. 2. March, 1938.

Austin Phelps. The variation in the silicate content of the water in Monterey Bay, California, during 1932, 1933 and 1934. 36 pp. 13 figs.

Eugene A. Golomshtok. The Old Stone Age in European Russia. 286 pp. 37 pls.

PROCEEDINGS:

Volume 78, No. 3. January, 1938.

Marian W. Smith. The war complex of the plains Indians. pp. 425-464.

H. R. Seiwel and Gladys Eddy Seiwel. The sinking of decomposing plankton in sea water and its relationship to oxygen consumption and phosphorus liberation. pp. 465-481.

W. M. Barrows, Jr., and J. R. Murlin. New automatic calorimeter for the continued measurement of heat production over long periods of time. pp. 483-512.

G. H. Parker. Melanophore responses and blood supply (vasomotor changes). pp. 513-527.

No. 4, March, 1938.

Arthur O. Lovejoy. The historiography of ideas. pp. 529-543.

James T. Shotwell. International peace. pp. 545-550.

Frank Benford. The law of anomalous numbers. pp. 551-572.

H. A. Bethe, M. E. Rose and L. P. Smith. The multiple scattering of electrons. pp. 573-585.

Rudolf Höber and Elinor Moore. Experiments concerning the secretory activity of the liver. pp. 587-593.

Charles A. Kofoid and Datus M. Hammond. The neuromotor system of *Anoplophrya lumbrici*, a degenerate ciliate from the earthworm *Octolasion cyaneum*. pp. 595-614. 2 pls.

E. Horne Craigie. The blood vessels of the brain substance in some amphibians. pp. 615-649.

J. C. Jensen. Evaporation and rainfall studies in the northwest Minnesota lake region. pp. 651-670.

Emory R. Johnson. The Panama Canal tolls problem and its solution. pp. 671-674.

Volume 79, No. 1, April, 1938.

Symposium on the geophysical exploration of the ocean bottom:

Richard M. Field. The importance of geophysics to submarine geology. pp. 1-7.

G. T. Rudé. New methods of marine surveying. pp. 9-25. 11 figs.

H. C. Stetson. Present status of the problem of submarine canyons. pp. 27-33.

Charles Snowden Piggot. The technique of securing undisturbed core-samples of the ocean bottom. pp. 35-40. 2 figs.

W. H. Bradley, M. N. Bramlette, J. A. Cushman, L. G. Henbest, K. E. Lohman and P. D. Trask. The Geological Survey's work on the Piggot North Atlantic deep sea cores. pp. 41-46.

Maurice Ewing. Marine gravimetric methods and surveys. pp. 47-70. 4 figs.

Harry Hammond Hess. Gravity anomalies and island arc structure with particular reference to the West Indies. pp. 71-96. 2 figs. 2 colored maps.

N. H. Heck. The rôle of earthquakes and the seismic method in submarine geology. pp. 97-108. 5 figs.

John A. Fleming. Terrestrial magnetism and oceanic structure. pp. 109-125. 15 figs.

Round table discussion. pp. 127-144.

No. 2, June, 1938.

George F. McEwen. Modern dynamical oceanography: an achievement of applications to ocean observations of principles of mechanics and heat. pp. 145-166.

Horace G. Richards. Land mollusks from the Island of Roatan, Honduras. pp. 167-178. 3 pls.

Edwin G. Conklin. Disorientations of development in *Crepidula plana* produced by low temperatures. pp. 179-211. 9 pls.

John W. Nuttycombe and Aubrey J. Waters. The American species of the genus *Stenostomum*. pp. 213-301. 8 pls.

George M. Reed. Influence of the growth of the host on oat smut development. pp. 303-326.

No. 3, September, 1938.

Sergei I. Gaposchkin. A study of the absolute dimensions of eclipsing variables. pp. 327-340.

S. A. Mitchell. With an astronomer on an eclipse expedition. pp. 341-360. 7 pls.

Alexander Goetz and S. Scott Goetz. Vitrification and crystallization of Protophyta at low temperatures. pp. 361-388.

Karl K. Darrow. Neutral particles in physics. pp. 389-397.

S. Whittlemore Boggs. The map of Latin America by treaty. pp. 399-410.

T. M. Sonneborn. Mating types in *Paramecium aurelia*: diverse conditions for mating in different stocks; occurrence, number and interrelations of the types. pp. 411-434.

V. M. Slipher. The trans-Neptunian planet search. pp. 435-440.

E. C. Slipher. The planets from observations at the Lowell Observatory. pp. 441-473. 11 pls.

No. 4, November, 1938.

Robert R. McMath. Recent studies in solar phenomena. pp. 475-498. 4 pls.

Fred L. Whipple. Photographic meteor studies, I. pp. 499-548.

William H. Brown. The bearing of nectaries on the phylogeny of flowering plants. pp. 549-595. 12 pls.

Davenport Hooker. The origin of the grasping movement in man. pp. 597-606.

William E. Lingelbach. Neutrality versus alliances. Belgium and the Revolution in international politics. pp. 607-636.

A. T. Volwiler. Harrison, Blaine, and American foreign policy. pp. 637-648.

D. Sutherland Davidson. An ethnic map of Australia. pp. 649-679. 1 pl.

George H. Chase. The *Corpus Vasorum Antiquorum*. pp. 681-693.

J. S. P. Tatlock. Geoffrey of Monmouth's motives for writing his *Historia*. pp. 695-703.

Franklin Edgerton. Etymology and interpretation. pp. 705-714.

Gerhard Fankhauser. Triploidy in the newt, *Triturus viridescens*. pp. 715-739. 4 pls.

MEMOIRS:

Volume IX. D. S. Davidson. A preliminary consideration of aboriginal Australian decorative art. 147 pp. 91 figs. January, 1938.

YEAR BOOK for 1937. 433 pp. April, 1938.

SERIAL LIST OF PUBLICATIONS. 93 pp. November, 1938.

COST OF PUBLICATIONS DURING 1938

PROCEEDINGS, Vol. 78, No. 3	\$ 548.82	
No. 4	836.26	
Vol. 79, No. 1	1,077.25	
No. 2	981.87	
No. 3	881.09	
No. 4	1,368.67	\$ 5,693.70
TRANSACTIONS, Vol. 29, Pt. 2	\$2,782.19	
MEMOIRS, Vol. IX	805.25	
YEAR BOOK for 1937	2,026.21	
LIST OF PUBLICATIONS	613.08	

\$11,920.43

The total return from sales of publications during 1938 was \$1,763.77.

5. REPORT OF THE COMMITTEE ON RESEARCH

The Laws (Chap. V, Art. 4) specify that the Committee on Research shall consist of the President, *ex officio*, and of not fewer than six other members, representative of the four classes, who shall serve for three years and who shall be nominated by the President and elected by the Council. In practice it has been found desirable to have more than six elected members in order to obtain wider representation of subjects. While regular election to the Committee is for a term of three years several persons so elected have found it necessary to resign and others have been appointed to fill out their terms. There is no provision in the Laws against the reelection of a person to serve on this Committee.

The Committee for 1938 consisted of the following persons:

Albright, William F. (Classical Archaeology)
Buddington, Arthur F. (Geology)
Cheyney, Edward P. (Modern History)
Chinard, Gilbert (Philology and Literature)
Conklin, Edwin G., *Chairman* (Biology)
Kidder,¹ Alfred V. (American Archaeology)
Miller, John A. (Astronomy)
Richards, Alfred N. (Physiology and Medicine)
Swann, W. F. G. (Physics)
Taylor, Hugh S. (Chemistry)
Morris, Roland S., *President* (Jurisprudence and Administration)

The Committee held five meetings during the year 1938, namely on February 11, April 8, June 10, October 16 and December 9. All applications and supporting letters are manifolded and sent to the members of the Committee about ten days in advance of the meeting; in many cases members consult by correspondence or in person with applicants, or with persons conversant with the appli-

¹ Dr. Kidder found it necessary to resign owing to the fact that he had to be out of the country a large part of the year. Edward P. Cheyney and Gilbert Chinard were appointed to serve on the Committee for the next three years.

cants or their projects. This work requires considerable time and labor and it has been done faithfully and without compensation.

THE PENROSE FUND

In the five meetings of the year 169 applications for grants from the Penrose Fund have been considered for a total sum of \$288,969.00 and 90 grants were made of a total sum of \$77,550.00 as follows:

1938, February 11

Grant No. 195a—Francis Harper, American Committee for International Wild Life Protection, for a detailed survey of the extinct and vanishing mammals of the world since the classical period. (Extension of preliminary Grant No. 195, \$250, 1937.)	\$ 750
Grant No. 201—Edward W. Berry, Johns Hopkins University, for artistic assistance in the study of the Tertiary flora of Cuba.	100
Grant No. 202—Ralph E. Cleland, Goucher College, for research assistance in the continuation of work on cytogenetics and phylogeny of <i>Onagra</i> (evening primrose) (fifth grant).	1,500
Grant No. 203—H. S. Jennings, Johns Hopkins University, for a research associate in the study of the cytology of ciliate protozoa, in particular the chromosomes and their behavior at conjugation in <i>Paramecium bursaria</i> and in other species of <i>Paramecium</i> ; also the chromosomes in the <i>Opalinidae</i>	1,200
Grant No. 204—Ernest W. Brown, Yale University, and W. J. Eckert, Columbia University, for rental and operation of the calculating machines for the continuation of the verification of the polar coordinates which are used to predict the moon's place (second grant).	500
Grant No. 205—William Berryman Scott and Glenn L. Jepsen, Princeton University, for remuneration of the artist in the continuation of the monograph of White River Mammalia (third grant).	600
Grant No. 206—Donald H. Andrews, Johns Hopkins University, to cover cost of liquid air and incidental expenses in connection with the measurement of the heat capacities of nine or more organic compounds to be made in the range 1° to 300° K together with supplementary measurements necessary to determine the values of the free energy and entropy at 300° K.	1,000
Grant No. 207—D. H. Kabakjian, University of Pennsylvania, for technical assistance in the study of the energy levels in pure or activated crystals and the dependence of these on physical structure.	350
Grant No. 208—J. Kenneth Donahue, College of Charleston, for travel expenses, maintenance of animal colony, etc., in the study of the occurrence of hormones in marine invertebrates with special reference to the female sex hormone.	500

Grant No. 209—Nabih Amin Faris, Princeton University, for photo-stats, books, etc., for the continuation of the editing from old manuscripts and translating into English the major work of al Ghazzālī, the <i>Ihyā' 'Ulūm al-Dīn</i> , which treats of Moslem theology and jurisprudence, Moslem political theory and constitutional law (second grant).	500
Grant No. 210—Clarence E. McClung, University of Pennsylvania, expenses of a collector in the continuation of the project of bringing together as representative a group as possible of the short-horned grasshoppers for cytological, genetical and phylogenetic studies (second grant).	400
Grant No. 211—Alexander Weinstein, Columbia University, for an historical, biological and philosophical study of human genetics.	1,500
Grant No. 212—Robert Gaunt, New York University, for technical assistance in the study of the function interrelationship of the adrenal cortex and the pituitary.	500
Grant No. 213—Richard Krautheimer, Vassar College, for architect, technical assistance, photographs and travel in making an historical and architectural analysis of the early Christian basilicas in Rome as far as preserved either completely or in remnants, IV to IX centuries.	1,500
Grant No. 214—Wesley L. Bliss, University of New Mexico, for travel, guides, clerical assistance, field work, etc., in the study of evidence of early man in the area on the eastern flank of the Canadian Rockies to the Arctic and in the upper Yukon with emphasis upon glacial, and other geological and geographical conditions that may have influenced him.	1,000
Grant No. 215—John H. Davis, Jr., Southwestern College, for field work, travel, equipment and technical assistance in the study of mangroves and land building in southern Florida (second grant).	425
Grant No. 216—Edwin Francis Carpenter, University of Arizona, for part cost of apparatus for the study of the distribution of color in the extra-galactic nebulae.	700
Grant No. 217—F. Martin Brown, Colorado College, for technical assistance and materials for a study of the microscopic structure of animal hairs and the preparation of keys, drawings and description to be used in assisting in the determination of the various furs used by the aborigines of the southwestern states for making textiles, cords, etc.	600
Grant No. 218—Thomas Hale Ham, Harvard Medical School, for an investigation on the mechanism of blood destruction in normal and pathological conditions.	1,500
Grant No. 219—Carl G. Vinson, University of Missouri, to purchase a large angle centrifuge for a chemical investigation of disease virus.	500
Grant No. 220—Clarence Zener and Robert H. Randall, College of the City of New York, for one-half the cost of apparatus needed	

for conducting a research to establish experimentally the relation between internal friction and grain size in non-ferrous metals.	600
1938, April 8.	
Grant No. 221—Leslie Spier, Yale University, for travel expenses, informant and interpreter in the completion of an extended ethnography of the Modoc Indians of Oregon.	750
Grant No. 222—Dwight C. Carpenter, New York State Experiment Station, for the purchase of several quartz absorption cells for the study of the effect of light on proteins and amino-acids.	300
Grant No. 223—Rudolf Höber, University of Pennsylvania, for a research assistant in the continuation of investigations on the secretory activity of the liver (fifth grant).	1,200
Grant No. 224—Erwin K. Mapes, University of Iowa, for clerical assistance, field expenses, photography and travel in identifying and collecting the writings of the Mexican author, Manuel Gutiérrez Nájera, together with critical and other data regarding his life and work.	500
Grant No. 225—Samuel L. Leonard, Rutgers University, for apparatus, animals, chemicals and technical assistance in the study of hypophysis-thyroid-gonad relationship.	735
Grant No. 226—Harold S. Colton, Museum of Northern Arizona, for field work and supplies in carrying on archaeological excavations in northwestern Arizona.	1,000
Grant No. 227—H. O. Burdick, Alfred University, for technical assistance, animals and apparatus, in the continuation of studies of the physiology of the fallopian tubes (second grant).	500
Grant No. 228—Ernst C. Abbe, University of Minnesota, for field expenses in a detailed field study of the flora of the Richmond Gulf Region (east coast of Hudson Bay) to gather further evidence concerning the interrelationship of historical and environmental factors in the floristic development of the Labrador Peninsula.	450
Grant No. 229—J. J. Nassau and S. W. McCuskey, Case School of Applied Science, for the construction of a photoelectric machine for counting stellar images of varying degrees of brightness on a photographic plate.	300
Grant No. 230—Frank T. Gucker, Jr., Northwestern University, for technical assistance in determining the heat capacities and heats of dilution of solutions of the simpler amino acids and their uncharged isomers.	650
Grant No. 231—Kenneth N. McKee, New York University, for travel and other expenses in connection with the study of the French theater during the Revolutionary period.	600
Grant No. 232—William J. Robbins, New York Botanical Garden, for technical assistants in the study of the condition necessary for	

the unlimited growth of excised tissues of higher plants, primarily excised root tips.	1,500
Grant No. 233—E. J. Workman and R. E. Holzer, University of New Mexico, to make electrical measurements of the surface field under thunder clouds and charge distributions within the clouds for the purpose of studying quantities of electricity involved in lightning discharges (second grant).	750
Grant No. 234—V. M. Slipper, Lowell Observatory, for technical assistance in the investigation of the spectrum of the light of the night sky (third grant).	500
1938, June 10.	
Grant No. 235—Biological Abstracts, supplementary emergency support for the publication of abstracts from biological journals of the world.	5,000
Grant No. 236—Edward Girden, Brooklyn College, for supplies in connection with studies on cerebral mechanisms and hearing—localization of the cortical determinants for specific auditory frequencies as tested by the L-R discrimination (second grant).	400
Grant No. 237—Arthur L. Hughes, Washington University, for assistance and apparatus in the study of (a) the distribution of velocities among atomic electrons and (b) conductivity and, in particular, the photoconductivity of insulating liquids and solids.	650
Grant No. 238—Mary R. Haas, Eufaula, Oklahoma, for travel and necessary expenses in making a special field investigation of the history and development of the extant towns which formerly comprised the powerful Creek Confederacy.—New information concerning their recent history is to be obtained through a study of the consequences wrought by historic catastrophes (e.g. the Civil War) in which they as well as their white neighbors shared. New information concerning their earlier history to be obtained through a study of the dialectic variations exhibited by the different towns, since the conservatism of language retains evidence of earlier historical connections long after they have passed from memory.	1,250
Grant No. 239—William Steel Creighton, College of the City of New York, for assistance of an artist in the completion of a handbook of North American ants begun in collaboration with the late Dr. W. M. Wheeler.	700
Grant No. 240—William C. Stadie, University of Pennsylvania, for research associate in connection with the study of chemical action of insulin upon the intermediary metabolism of isolated, surviving tissue of normal and pathological animals.	1,500
Grant No. 241—William Henry Brown, Johns Hopkins University, for an artist and a typist in the preparation of a monograph on the phylogenetic classification of flowering plants.	2,000
Grant No. 242—Ronald L. Ives, Science Service, for expenses in collecting evidence of glaciation, etc., from reservoir sites of Colo-	

	rado-Big Thompson Diversion project before they are submerged by water and used as fill in dams, etc.	180
Grant No. 243—	Christianna Smith, Mt. Holyoke College, for technical assistance in (a) the study of age involution of the thymus gland and the analysis of the factors behind the formation of Hassall's corpuscles and (b) the fetal liver during its hematopoietic stage in tissue culture.	600
Grant No. 244—	Ludvig Gustav Browman, Montana State University, for equipment for the study of estrous and activity rhythms, and reproductive behavior of rats born and kept in constant darkness as contrasted with those kept in constant light.	260
Grant No. 245—	Josiah Cox Russell, University of North Carolina, for travel and other expenses in connection with studies in the history of the population of Medieval England.	1,500
Grant No. 246—	R. T. Hill, Indiana University School of Medicine, for technical assistance and supplies in an investigation of the androgenic function of ovaries.	1,000
Grant No. 247—	Carl C. Lindegren, University of Southern California, for technical assistance in the analysis of the mechanism of crossing-over by growing to maturity the plants produced from the spores of <i>Neurospora crassa</i> (second grant)...	500
Grant No. 248—	Martin Kilpatrick, University of Pennsylvania, for research assistant and materials for the determination of relative acid strengths in aqueous and non-aqueous solutions.	1,000
Grant No. 249—	Frank E. E. Germann, University of Colorado, for research assistants and supplies in the study of anomalous double refraction observed by Germann and Metz of solutions of certain inorganic salts in water to determine whether the effect is due to ions, or to molecules formed by hydrolysis.	2,000
Grant No. 250—	Jean Broadhurst, Columbia University, for trained assistants, and apparatus in the development of a virus test for scarlet fever susceptibility and immunity.	1,750
Grant No. 251—	C. L. Turner, Northwestern University, for field work in Mexico on the study of viviparity in teleost fishes; evolution of structures associated with viviparity in the family Goodeidae, a group of fishes confined to the Mexican Plateau and adjacent regions.	250
Grant No. 252—	Horace G. Richards, New Jersey State Museum, for travel expenses in connection with the collection of land and freshwater mollusks from the Corn Islands, Nicaragua, and adjacent mainland; study of these mollusks with particular attention to their bearing on problems of paleogeography (third grant).	250
Grant No. 253—	S. C. Brooks, University of California, for assistance in the study of the penetration of alkali and alkaline-earth metal ions and halides as a function of time and concentration, and metabolism of the protoplasm and sap of living plant cells.	200

Grant No. 254—Philadelphia Institute for Medical Research, for research assistants and supplies in the continuation of studies, through succeeding generations of the rôle of the thymus in the rate of growth and development of the young (fourth grant).	2,000
Grant No. 255—Peter J. Rempel, University of Southern California, for field work, assistance, etc., in the study of several plant associations, namely conifer forest, chaparral, pinyon pine woodland, and desert, on the desert side of the San Jacinto and Santa Rosa ranges, California, and in chaparral on the seaward side of the same mountains, with respect to the differences in their environmental complexes and the phytometric responses in growth occasioned by these, with a view to elucidate some of the reasons for the vegetational differences	500
Grant No. 256—Donald Young Solandt, University of Toronto, for apparatus in an experimental study of the accommodation process in the excitation of irritable tissues with special reference to the excitation of single cells of such tissues.	350
Grant No. 257—Nathaniel E. Griffin, Cambridge, Mass., for support of an investigation of the sources and influence of the <i>Historia Destructionis Troiae</i> of Guido de Columnis (to form Volume 2 in a 3-volume edition of this work).	500
Grant No. 258—For expenses in preparation for publication in the American Philosophical Society's MEMOIRS of monograph by Ann Hoskin Ehrlich under direction of Rhys Carpenter and W. F. Albright.	50
1938, October 14.	
Grant No. 259—Montague Francis Ashley-Montagu, Hahnemann Medical College, for travel and clerical assistance in a study of the development of interest in the comparative anatomy of the primates as illustrated by the life and work of Edward Tyson (1650-1708).	400
Grant No. 260—Gaylord P. Harnwell, University of Pennsylvania, for the construction of a new type of β -ray spectrograph to investigate the β -ray spectra of electron-emitting and positron-emitting radio-elements	1,000
Grant No. 261—Roberts Rugh, Hunter College and Columbia University, for assistance and supplies for (1) comparative study of the morphology and physiology of the urino-genital systems of Amphibia, (2) study of the effect of hypophysectomy on the testis of the immature and mature bullfrog, and (3) study of the susceptibility of frog gametes to X-radiation prior to and subsequent to fertilization.	350
Grant No. 262—Astronomical Hollerith-Computing Bureau, Columbia University, for assistance and materials in the preparation of a punched card catalogue of the data contained in the Boss General Catalogue of 33342 stars and of other quantities derived from these.	1,200

Grant No. 263—Jacob Klein, St. John's College, Annapolis, for an intensive study of classical physics, its problems, principles and origins starting from the work of Galileo.	1,200
Grant No. 264—J. Bennett Nolan, Reading, Pa., for clerical assistance in the preparation of an annotated edition of the diary of Henry Marchant (1741-1796).	100
Grant No. 265—Jean Piatt, University of Vermont, for assistance and apparatus in an investigation of the factors underlying the anatomical and physiological specificity which exist between any given muscle and the nerve which supplies it; the nerve-muscle specificity problem.	500
Grant No. 266—Malcolm Dole, Northwestern University, for a research assistant in a study of the effect of negative ions on the glass electrode.	800
Grant No. 267—Karl F. Herzfeld, Catholic University of America, for a research associate in an experimental investigation of the physical theory of the connection between molecular structure and the absorption spectrum of organic compounds (second grant).	1,200
Grant No. 268—Thomas Hume Bissonnette, Trinity College, Hartford, for assistance and supplies in an investigation of sexual photoperiodicity and related phenomena in animals.	1,000
Grant No. 269—Harry Richard Seiwel, Woods Hole Oceanographic Institution, for an assistant in the investigation of internal waves in the North Atlantic Ocean.	1,200
Grant No. 270—T. M. Sonneborn, Johns Hopkins University, for research assistant and technician in the study of the genetics of <i>Paramecium</i> —the analysis of the mechanism of inheritance, particularly inheritance of mating type (second grant).	900
Grant No. 271—Fred A. Barkley, Montana State University, for travel and supplies for a bibliographical and herbarium study in preparation of a monograph of the <i>Anacardiaceae</i> (Sumac family).	550
Grant No. 272—R. G. Herb, University of Wisconsin, for supplies in connection with studies in nuclear physics by means of a 2.4 million volt electrostatic generator.	400
Grant No. 273—Fred E. D'Amour, University of Denver, for technical assistance and supplies in connection with the study of the endocrine control of ovulation and related physiologic changes (second grant).	1,000
Grant No. 274—E. B. Babcock, University of California, for technical assistance in the cytogenetic investigations in the <i>Cichorieae</i> and their bearing on taxonomy, phylogeny and evolution of the higher plants.	400
Grant No. 275—Eliot R. Clark, University of Pennsylvania, for technical assistance in the continuation of the study of the growth	

and behavior of various cells, tissues and organs as observed microscopically in the living mammal with the aid of permanently installed transparent chambers and windows (second grant).	300
Grant No. 276—Robley D. Evans, Massachusetts Institute of Technology, for research assistants, equipment and supplies for an international interchecking program to evaluate, correlate and extend the scattered knowledge of the radioactivity of natural materials.	3,000
Grant No. 277—Arthur M. Banta, Brown University, for a research assistant in the study of the effect of the characters (phenotype) of the mothers upon the characters (phenotype) of her offspring, apart from her genetic constitution (genotype). . . .	1,200
Grant No. 278—Gregory Pincus, Clark University, for a research assistant in the study of the metabolism of rabbit eggs and embryos in different inbred strains and in hybrids between them, with particular reference to the metabolic basis of size differences in early ova.	1,200
Grant No. 279—Nabih Amin Faris, Princeton University, for photographic supplies and photostats for a critical and comparative study of the Arabic calligraphy based on old manuscripts, with a view to determining the development of the Arabic characters, diacritical points, and vowel signs.	300
Grant No. 280—Edwin R. Helwig, University of Pennsylvania, for African travel expenses in connection with the collection of material for the study of the phylogenetic history of the chromosome complex in the Orthoptera.	350
Grant No. 281—John Edward Dinsmore, Herbarium of the American Colony, Jerusalem, Palestine, for travel and technical assistance in a study of the taxonomy of the iris in Syria and Palestine and the discovery of new species.	300
1938, December 10.	
Grant No. 282—Reginald D. Manwell, Syracuse University, for experimental animals in connection with the study of the exoerythrocytic cycle in avian malaria, and its relation to the development of immunity; the study to be centered about <i>Plasmodium circumflexum</i>	300
Grant No. 283—John Ernst Weaver, University of Nebraska, for technical assistance, travel in connection with studies on the damage done by drought, the adjustment of grassland to these injuries, and the method and rate by which prairie is being re-established.	450
Grant No. 284—Ronald L. Ives, Science Service, for field expenses for the continuation and probable completion of photography of the areas in Middle Park, Colorado, to be submerged by the waters of the reservoirs of the Colorado-Big Thompson Reclamation Project (second grant).	100

Grant No. 285—University Museum, University of Pennsylvania, for Excavations at Piedras Negras, Guatemala.	3,000	1
Grant No. 286—Christina Hallowell Garrett, Boston, for field work and travel expenses in an investigation of the origins of Elizabethan Puritanism.	1,000	
Grant No. 287—Simon Freed, University of Chicago, for part payment of a research assistant in the study of the symmetries of the electrical fields about ions in solution and their relation to chemical thermodynamics.	750	
Grant No. 288—James Edward Carver, College of the City of New York, for travel, rotographs, books, etc., in the preparation of an edition of the North English Homily Cycle, a late 13th or early 14th century cycle of sermons and <i>exempla</i> for the church year, in twenty thousand lines of short English couplets.	1,250	
Grant No. 289—Henry Drinker, Merion, Penna., and Carleton Sprague Smith and Carl Engel, New York, for part payment of honorarium, travel expenses, etc., of Hans Theodor David, for a study of the music of the German sectarians in Pennsylvania focussed on the works of Johann Conrad Beissel and the Sabbatarian Anabaptists at Ephrata.	1,000	

The distribution of these grants to various subjects is shown in the following table:

		Grants	Amount
Class I.	Astronomy	5	\$ 3,200
	Physics	8	8,400
	Chemistry	8	6,700
	Meteorology	1	750
	Photography	2	280
Class II.	Paleontology	2	700
	Oceanography	1	1,200
	Zoology	15	9,610
	Anatomy	2	800
	Genetics	2	2,000
	Botany	9	7,650
	Ecology	1	425
	Bacteriology	1	1,750
	Anthropology	2	1,750
	Psychology	1	400
	Physiology	11	9,885
	Pathology	1	1,500
Class III.	American History	1	100
	History of Medicine	1	400

(continued)

1 \$3,000 transferred from Grant No. 150 (1937).

		Grants	Amount
Class IV.	Medieval History	2	2,500
	Archaeology	4	6,100
	Linguistics	3	2,050
	Literature	3	2,750
	Music	1	1,000
	Drama	1	600
General.	Biological Abstracts	1	5,000
	Preparation of Manuscript	1	50
Total		90	\$77,550

The budget for 1938 assigned \$50,000 from the Penrose Fund for the support of research during the calendar year. At the time of the General Meeting in April it was evident that this sum would not be sufficient to meet the many important applications which were being made for aid in promoting research and on April 22 it was voted by the Society to recommend to the Committee on Finance that the research budget for the year be increased by the sum of \$25,000. At the beginning of the year there was a deficit of \$225.92 and \$2,000 had been committed for a grant made in 1937 to be taken out of the 1938 budget, making a total sum of \$72,774.08 (plus \$19.21 in refunds) available for research for the year 1938. During the year 90 grants amounting to \$77,500 were awarded. Of this sum \$72,700 was drawn from the 1938 budget (a balance of \$93.29 to be carried over to 1939) and \$4,850 is to be drawn from the 1939 budget.

REPORTS FROM RECIPIENTS OF GRANTS FROM THE
PENROSE FUND

(ALPHABETICALLY ARRANGED)

ACADEMY OF NATURAL SCIENCES

HELLMUT DE'TERRA

Grant No. 170 (1937). Geological and archaeological studies on Early Man in Southeastern Asia.

In the winter and spring of 1937 and 1938 the Academy of Natural Sciences of Philadelphia and the Peabody Museum of Harvard University jointly sponsored a geological and archaeological expedition to Burma and Java under the directorship of Dr. H. deTerra. The work was made possible by a generous grant from the Penrose Fund of the American Philosophical Society, supplemented by other grants-in-aid from Harvard University and the Carnegie Institution of Washington. The other members of the party were: Dr. P. Teilhard de Chardin, consulting paleontologist of the National Geological Survey of China and Dr. H. L. Movius, Research Associate in Old World Archaeology at the Peabody Museum of Harvard University. Dr. Movius' expenses were paid in full by the Peabody Museum.

It was planned to investigate certain critical areas where the geological and archaeological data would permit of a clearer conception regarding the stratigraphy and cultural position of Early Man in Southern Asia. The object of this investigation was reached inasmuch as an extensive and hitherto unknown Early Paleolithic culture was found in association with fossil fauna and with terraces, the latter making possible regional correlations of archaeological data between India, Burma, China and Java. On the geological line, the studies on Ice Age formations revealed that the glacial cycle as previously investigated in the Himalayan regions of Northwest India, is correlatable with a pluvial cycle, both apparently indicating the impact of widespread changes

throughout the Quaternary which are most probably connected with climatic fluctuations. The data on terraces and Pleistocene formations in Burma can be computed with those previously found in India and with others known from the Yangtse Valley of South China. In this way it is hoped that a new and practical conception of Pleistocene stratigraphy in Eurasia will result, the application of which in regard to Human Origins should prove to be of value for further investigations.

In the archaeological field, a new center of Early Paleolithic cultures was disclosed in Burma which enables us now to visualize for the first time the stratigraphic position and typological evolution, as well as the dispersal of the earliest Stone Age races in Southern and Eastern Asia. The first traces of Man appear uniformly in the early part of the Middle Pleistocene and from then on the Stone Age tools are found throughout Late Quaternary formations (Upper Paleolithic) into post-Pleistocene deposits which yield a Neolithic culture. The implement types, which include chopping tools, crude scrapers, a few flake implements and cores, are made of silicified tuff or fossil wood. Hand-axes, so characteristic for the Stone Age of Europe and Africa, are entirely absent, a fact which seems to indicate a more definite association with an Eastern Asiatic focus rather than with a South Indian one.

The expedition remained for five months in Upper Burma and then proceeded to Java where several excursions were made under the guidance of Dr. von Koenigswald. These study tours led to all the important sites where fossil human remains had been found, as for instance to Trinil, to Sanjiran (site of the new *Pithecanthropus* remains) and to Modjokerto where the Early Pleistocene infant skull of *Homo* was found.

The expedition results will be worked out partly at the Peabody Museum of Harvard University and partly in Philadelphia.

DETEREA, H., 1938. Preliminary Report on Recent Geological and Archaeological Discoveries Relating to Early Man in Southeastern Asia. *Proc. Nat. Acad. Sciences* 24: 407-413.

—, 1938 (with DE CHARDIN, P. TEILHARD and MOVJUS, H. L.). Geological and Archeological Aspects of Southeastern Asia. *Nature* 142: 275-278.

DONALD H. ANDREWS, Johns Hopkins University

Grant No. 206 (1938). Heat capacity of organic compounds at low temperatures.

The original plan for this research project called for the measurement of the low temperature heat capacities of certain organic compounds, for which concurrent studies are being made involving infra-red and Raman spectra and heats of reaction. The object was to obtain data which might provide an entering wedge for a broad study of organic reactions and structure, leading eventually to molecules of biochemical interest.

In all work of this sort the primary difficulty lies in getting the compounds sufficiently pure and in large enough amounts. With this in mind, a design has been worked out for a new kind of calorimeter for liquid helium temperatures which should make possible the measurement of microscopic amounts of material with an accuracy considerably greater than that previously obtained by macro methods. The calorimeter consists of a film of superconducting metal supported on a thin film of lacquer. In the transition range between superconduction and ordinary conduction the change of a billion fold or more in the electrical resistance of the metal makes possible accurate measurement of very small temperature changes. This property coupled with the small heat capacity of the metal at low temperatures makes the film an ideal micro-calorimeter. The material to be studied is deposited as a monolayer or as a film on the metal film. By shifting the superconducting transition temperature with an external magnetic field and by using different metal films measurements can be made over the entire range from 1° to 10° . It is in this region that we may expect to find the most significant evidence concerning changes in entropy due to the larger features of form and organization in biochemical molecules.

To date we have constructed and have in successful operation the apparatus for making the calorimeter films. The cryostat for attaining the liquid helium temperatures has been constructed and is being tested. We expect to be able to report on the behavior of the films by April and to have completed measurements up to room temperature on a number of substances by the fall.

J. A. BEARDEN, Johns Hopkins University

Grant No. 92 (1936). To study the shapes and wave-lengths of the K and L series x-ray lines of the rare earth elements (atomic numbers 57-71).

The width and index of asymmetry of the fluorescent $K\alpha_1$, $K\alpha_2$ and $K\beta_1$ emission lines of pure Zn, Cu, Fe, Mn, Cr and 26 compounds, including the halides and sulfides of Cu and Fe, have been measured with a double crystal spectrometer. The changes between the shapes of the lines of the metals and their oxides are in good agreement with those determined by Roseberry and Bearden¹ for the same emission lines produced by direct excitation (electron impact), and indicate that the method of excitation does not influence the shape of the lines. However, the present results give the width of the $K\alpha_1$ line of CuF_2 as 9 per cent greater than the width of the pure metal, whereas Wilhelmy² found a 25 per cent widening for direct excitation. A study of the Cu and Fe halide and sulfide lines shows some regularities in the change of the width and index of asymmetry with the percentage composition, the most outstanding of which are for the iron sulfides FeS , Fe_3S_4 , Fe_2S_3 , FeS_2 . As the percentage of sulfur increases both the width and the index of asymmetry decrease for all lines, the maximum change being as much as 42 per cent for the width of the $K\alpha_1$ lines.

The widths, relative intensities and wave-lengths of the L series lines of the rare earth elements should be of especial interest in the study of the variations of the above quantities with atomic number. Most of the rare earths have a hexagonal close-packed crystal structure; the rest a face-centered cubic. Within these groups, then, the effects of adding electrons to the N shell can be studied without also raising questions such as the differing influence of the crystal structure. The technique of forming x-ray targets of these soft metals suitable for ionization intensity measurements is described. Preliminary to the main program of the rare earths the L lines of W(74) were measured by means of the double crystal spectrometer. These results are compared with previous ones on Au(79).³

OBERT, LEONARD, 1938 (with SHAW, C. H.). A Study of the K Fluorescent X-Ray Lines of Chemical Compounds. *Phys. Rev.* 53: 919.

SHAW, C. H., 1938. The Widths and Relative Intensities of L Series Lines of the Rare Earth Elements. *Phys. Rev.* 53: 940.

¹ Roseberry and Bearden, *Phys. Rev.* 50, 204 (1936).

² Wilhelmy, *Zeits. f. Physik* 97, 312 (1935).

³ Richtmyer, Barnes and Ramberg, *Phys. Rev.* 46, 543 (1934).

RALPH A. BEEBE, Amherst College

Grant No. 119 (1936). Heats of adsorption of gases on chromic oxide at low temperatures.

The heats of adsorption at -183° C. have been measured calorimetrically using the six gases, argon, hydrogen, deuterium, carbon monoxide, nitrogen and oxygen on a reduced chromic oxide surface. The order of magnitude of the heats indicates that all these gases, with the single exception of argon, are held in part in the activated state as well as in the van der Waals state even at the low temperature -183° C.

At -183° C., the time-temperature curves obtained in the calorimeter with argon and with the two hydrogen isotopes were of normal form exhibiting a quick rise to maximum temperature and a subsequent almost negligibly slow cooling rate. With the other three gases, however, the time-temperature curves on a partially covered adsorbing surface were divided into an initial quick rise corresponding to a heat of 4 kcal. and a final slow rise ultimately reaching heats of 12, 8 and 27 kcals. respectively with carbon monoxide, nitrogen, and oxygen. The initial rapid process (heat 4 kcal.) is believed to be a van der Waals adsorption, and the final slow process seems to be a change in the adsorbed film from a van der Waals state to a final state of activated adsorption.

Heat measurements were made at 0° C. with carbon monoxide, nitrogen and oxygen. Comparing the results with the data at -183° it was found that the heats with nitrogen and oxygen at 0° C. were just about double the values at -183° . With carbon monoxide, however, the temperature coefficient of the heat of adsorption was small.

Preliminary measurements have been made with carbon monoxide, nitrogen, and oxygen on iron at -183° . This work is being continued.

Personnel: Ralph A. Beebe and D. A. Dowden.

- BEEBE, R. A., 1938. Adsorption Calorimetry, and an Account of Some Measurements at Low Temperatures. *Science*, Nov. 25. (Abstract.)
— 1938 (with DOWDEN, D. A.). Heats of Adsorption of Gases on Chromic Oxide at Low Temperatures. *Jour. Amer. Chem. Soc.* 60: 2912-2922.
— 1938. Adsorption Calorimetry and an Account of Some Measurements at Low Temperatures. *Proc. Amer. Philos. Soc.* 81: (in press).

N. J. BERRILL, McGill University

Grant No. 167 (1937). Tissue growth and replacement in postlarval growth and regeneration in vertebrates.

The comparative histology of vertebrates is a relatively unworked field, and this applies especially to questions of growth and replacement. In view of this the histology of various postlarval stages of the large-celled *Necturus* have been selected as the basic problem, and an attempt is being made to determine the method of growth of specific tissues at various stages, whether by regular mitotic division of fully differentiated cells, by amitotic division of such cells, or by addition to their number by multiplication and growth from either basement cell membranes or nests of other unspecialized cells. To compare what a certain tissue does normally in this respect with what it is capable of doing under stress, various amputations and injuries have been made with a view to studying the methods of replacement or regeneration. To serve as a comparison with conditions in *Necturus*, similar investigations on frog tadpoles and adults and on mice are in progress, to determine the effect of smaller, metabolically more active, cell types on the one hand and greater specialization and rapid growth rates on the other.

Among other results, it has been found in *Necturus* that growth of cartilage is by mitotic division of maturing cartilage cells and not from perichondrium or cell nests or by amitosis. In the case of gut epithelium the fully formed epithelial cells divide mitotically, losing their distinctive character in the process and re-acquiring it afterwards, and there is no evidence of cell nests at the base of the crypts as in the mouse. Retinal cells show no evidence of division, but retinal growth as a whole results from multiplication of cells in an unspecialized peripheral zone.

The histological studies are all in progress, and regeneration experiments have been started. The grant generously made from the Penrose Fund has made it possible to undertake this investigation on a comparatively large scale, and it is hoped that the final results will be commensurate with the assistance.

E. W. BERRY, Johns Hopkins University

Grant No. 174 (1937). To aid in the preparation of illustrations of South American fossil plants.

Grant No. 201 (1938). To aid in the preparation of illustrations of a miocene flora from Cuba.

The first grant resulted in the publication of the following papers containing twenty plates:

BERRY, E. W., 1937. Contributions to Paleobotany of South America. Johns Hopkins Univ. Studies in Geology 12: 1-114. Contents:

An Upper Cretaceous Flora from Patagonia.

A Paleocene Flora from Patagonia.

A Flora from the Forest Clay of Trinidad.

A Late Tertiary Flora from Trinidad.

Late Tertiary Plants from the Territory of Acre, Brazil.

Eocene Plants from Rio Turbio in the Territory of Santa Cruz, Patagonia.

The Parinas Sandstone of Peru.

Lower Cretaceous Plants Beneath the Floodplain of the Orinoco from the State of Monagas, Eastern Venezuela.

The second grant has been used in part and the manuscript of a report has been completed which will be published in the near future.

WESLEY L. BLISS, University of New Mexico

Grant No. 214 (1938). An archaeological and geological reconnaissance of Alberta, Mackenzie Valley, and Upper Yukon.

There have been a number of discoveries in North America of human remains and artifacts associated with extinct mammals of the Pleistocene. Did man exist during the Pleistocene or Ice Age on this continent? When did the mammals become extinct? To find the answers to these questions it was considered advisable to work in the glaciated and unglaciated areas of western Canada in order to definitely tie in, if possible, early cultures and culture complexes in relation to glacial chronology. Preliminary studies included research regarding known glacial conditions of the areas in which investigations were planned.

In September of 1937 Alden Hayes and the author began an archaeological survey in Alberta, Canada, for the University of New Mexico. This work was aided through the cooperation of

the Department of Geology at the University of Alberta. During the fall field work, Yuma artifacts were located in eastern Alberta as far north as Ponoka. A collection of celts from Pigeon Lake, Alberta, showed that a group of Indians with cultural affinities to those of central British Columbia had lived in that area. Obsidian artifacts found widely scattered over the province indicated trade or movements from Wyoming or the west coast. Abalone shell pendants showed connections with the California coast.

During the winter an expedition was organized to work in the Mackenzie River basin, from the Sikanni River, B. C., to the Arctic, and thence into the upper Yukon system of the Bell and Porcupine Rivers to Ft. Yukon. This expedition was financed by a grant from the Penrose Fund of the American Philosophical Society, and was supported by a fund from the University of New Mexico. The party was directed by the author. Other members of the party included Alden Hayes and Douglas Osborne of the University of New Mexico; Joseph Maloney, Leland Stanford University; Thomas Cain, University of Washington; and Richard Hayes, Hillsdale College, Michigan. These students furnished their own expenses for transportation and food.

In March three of the men went north with the supplies and equipment to the headwaters of the Sikanni River. In April the other two and the author flew in. When the river ice broke the party started north in three canoes.

Some ethnological work was done with the Slave Indians of the Nelson and Liard Rivers, and a collection of ethnological material was made.

Geological investigations showed that all of the area covered by the party along the Sikanni, Nelson, and Liard Rivers had been glaciated by the Keewatin ice. The outlying ranges of mountains had been shaped by Keewatin ice in a north-south axis from the mouth of the South Nahanni River to Ft. Liard. Evidence near Nahanni Butte showed that the Keewatin drift had not been disturbed by Cordilleran ice.

A cave in a limestone escarpment near Blue Fish Lake north of the Nahanni Butte was investigated. Evidence of occupation by man was found in a test trench excavation in the second of three rooms. Ash layers overlaid a bluish clay deposited during the glaciation of that area. Nothing was excavated except the test trench because of rock fall and need for special equipment. Other

caves in the area were mapped from information given by trappers and traders. Two of these are large, and according to information given, show smoke-darkened walls. It was decided to leave this area and specialize on it later during a summer season. Evidence of occupation by human beings below the blue clay, if found, would definitely prove man's existence in North America prior to the major advance of the Keewatin ice in that area. This area shows promising possibilities for future archaeological research on early man and his movements.

The Mackenzie River and the junctions of its tributaries did not produce any archaeological material.

Excavations of Eskimo sites were made on the Arctic Coast at Blow River. The material collected was of the transitional period from the aboriginal to the present mode of living.

From the Mackenzie delta the party went up the Rat River to the Little Bell River, a tributary of the Yukon. According to observations made on this river there is no indication of its valley ever having been glaciated. This shows an ice-free corridor probably existed throughout the Pleistocene from the Bering Straits eastward to the Mackenzie delta; however, further study should be made on this problem.

Near Loon Lake at the top of the pass artifacts were found on two terraces above the lake. Typologically these compare with the Pleistocene Lake Mohave artifacts discovered by Mr. and Mrs. W. H. Campbell on the old shore lines of Lake Mohave, California, and also closely resemble the artifacts from the lowest culture stratum at Borax Lake, California. Due to lack of time and to food shortage only a brief survey was made of the site; however, several weeks should be spent in the excavation of this site by a field party especially equipped for the purpose.

From Alaska the author returned to Alberta, and during September and October continued with field work in that province. Four Yuma sites were found near Cereal, and in western Saskatchewan two Folsom localities were examined. One of these, near Mortlach,¹ is on the Altamont (Coteau) moraine, which is dated as terminal Wisconsin, thus indicating that the Folsom is post-Wisconsin. A small flaked point of a distinctive type was found in eastern Alberta. It is identical with the microliths found by the University of Alaska on the university campus, and with those

¹ Site examined and reported by Edgar B. Howard.

of the dune dwellers of the Gobi. However, there is only the one isolated point at present, although future research may disclose more of these.

Geographical conditions show that the great river basins of the northwest were more probable routes of human migration from Asia than the rugged Alaskan and British Columbian coasts. More study of glaciation and morainal deposits just east of the Rocky Mountains is necessary before periods open to migration through that area are definitely determined. The Viking (Illinoian?) moraine of western Alberta, and the Altamont or Coteau (Wisconsin?) moraine have only been mapped to approximately the 55th parallel, but indicate an open corridor between the mountains and the continental glaciers during these periods.

The season's work was in the nature of a survey in an area in which nothing was known archaeologically. The expedition succeeded in isolating those districts which, with future excavation and development, should add materially to the knowledge of early man and his migrations in North America.

GABRIEL BONNO, University of California

Grant No. 164 (1937). Study of the intellectual relations between Great Britain and France from 1715 to 1735.

BONNO, G., 1938. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1937: 240-241.

—— Deux lettres inédites de Fontenelle à Newton (to appear in *Modern Language Notes*).

—— Quelques lettres inédites concernant les relations intellectuelles franco-anglaises au dix-huitième siècle (to appear in the *Revue de Littérature Comparée*).

—— Hans Sloane et les relations intellectuelles franco-anglaises au dix-huitième Siècle (to appear in the *Revue de Littérature Comparée*).

Of my coming book on "La Grande-Bretagne devant l'opinion française de la Régence aux Lettres anglaises," the first two chapters are now completed; Chap. I: Les moyens de contact intellectuel avec la Grande-Bretagne—Chap. II: L'appréciation des mœurs et du caractère britanniques.

WALLACE R. BRODE, The Ohio State University

Grant No. 82 (1936). To observe and spectrographically record the total eclipse of the sun at Ak-Bulak, Kazakhstan, Siberia, U.S.S.R.

The recipient of the grant was a member of the Harvard-Massachusetts Institute of Technology eclipse of the sun expedition to Siberia in 1936. Several hundred spectrograms were obtained of the flash spectrum and corona, and in view of the clarity and brilliance the data obtained promise to yield a considerable amount of valuable and important information. It will, of course, take some time to completely examine all of these negatives and interpret them. The recipient of this grant is particularly concerned with a study of the band spectra in the region from 5,200 to 6,300 Å. A further report will be made on these data.

In April, 1937 a paper entitled "The Spectrum of the Solar Corona" was read before the American Philosophical Society by Donald H. Menzel.

BRODE, WALLACE R., 1937 (with MENZEL, DONALD H., BOYCE, JOSEPH C., HEMMENDINGER, HENRY, and ATKINSON, R. d'E.). The Design and Operation of the Harvard—M. I. T. Eclipse Equipment. *Harvard Annals* 105. Reprinted from *Tercentenary Papers of the Harvard Observatory*, No. 5: 87.

S. C. BROOKS, University of California

Grant No. 253 (1938). The absorption of radioactive isotopes of univalent ions by protoplasm and sap of algal cells (*Nitella*).

Preliminary experiments have been continued exploring the three principal phases of the intake of ions into the protoplasm and sap of algal cells (*Nitella clavata*). (Brooks 1938b.) The movement of ions was followed by Geiger-Müller (β -particle counter) counts on preparations containing corresponding radioactive isotopes. For example, KCl contains about 93.3 per cent $^{39}_{19}\text{K}$, 6.7 per cent $^{41}_{19}\text{K}$ and a trace of radioactive $^{42}_{19}\text{K}$ produced by neutron bombardment.¹ Portions of 200 ml. of 0.01M K^+Cl were usually prepared with activities of about 20 μ C. Other isotopes show different proportions of β and γ activities and appropriate modi-

¹ The cyclotron of the Radiation Laboratory of this University has been used in preparing the isotopes furnished for our work. We are greatly indebted to Prof. E. O. Lawrence and to Dr. J. G. Hamilton and Dr. David C. Kalbfell for special isotopes.

fications were used. Na, Rb and Br besides K were studied. For details of technique see Brooks 1938a. Control of temperature and light has since been introduced.

Phase I, characterized as ion exchange, hereafter is considered to be "induced absorption" following Steward's (1937) terminology, and is distinguished from Phase III, which is "primary accumulation." Phase I consists of replacement of removable similar inorganic ions in the protoplasm as shown by the appearance of isotopes therein within 1-5 minutes in concentrations exceeding those of the corresponding experimental solutions. Apparently this intake continues, possibly complicated by Phase III, for several minutes or up to 2 or 3 hours. This exchange depends on the prior presence of measurable concentrations of such ions in the protoplasm at the start of the experiment. Cells removed from the normal environment, pool water, show much less such intake than similar cells allowed to take up ions from dilute solutions (e.g., KCl 0.01M for 24 hours). For example, the protoplasm, thus enriched, showed in 5 minutes 0.035M from a 0.01M K^*Cl solution, while control cell protoplasm in the same solution showed nothing.

Furthermore, it appears that this replacement approximates expected amounts when experimental solutions of different concentrations are used. Replacing K from KR by K^* , forming K^*R , where R is an unknown fixed anion of the protoplasm and K^* comes from an excess of a K^*Cl immersion solution, we may expect the activity of the protoplasm to be parallel to the external K^*Cl concentration. If the active mass (the term "active mass" denotes the total number of reacting, univalent, groups) of the protoplasm and the immersion solution were equal, the amount of K^* bound by R would vary as the square root of the concentrations of the immersion solution. The experimental conditions lie between these extremes, and the concentrations found in the protoplasm lie between the limits thus indicated. Thus, when the immersion fluids were 0.005M and 0.02M K^*Cl , the first maximum concentrations of K^* in the protoplasm (using means of 5 experiments) were 0.051M and 0.090M. Similar results were given with other ions.

The induced absorption as here observed means that at least some of the alkali metal ions are free to enter and leave the protoplasm, reaching (mobile) equilibrium for this process in a time of the order of 5 minutes to 2 hours. The protoplasm is therefore

highly permeable to such ions, contrary to our traditional ideas. The slow entrance of ions observed with osmotic methods is illusory and in this case depends upon limiting factors other than the permeability of the protoplasm or its surface layers (plasma membrane). Protracted experiments in which the concentrations of these ions in the sap of such cells were determined, are also illusory. The limiting factor in both primary and induced intake of ions is the provision of ions within the protoplasm (not the sap) for counter movement. In both cases the observed intake is originally due to organic ions which result from metabolism. The relation between metabolism and ion intake has been recognized by Osterhout (1926), Brooks (1929), Steward (1933), Lundegårdh and Burström (1933), and others. But neither the precise nature of the metabolism nor the identity of the ions is as yet known.

The second phase of intake (Phase II) is one in which ions are lost from the protoplasm. The tentative explanations offered (Brooks 1938b) seem to be incorrect. The actual explanation, or even the constant reality of this ion loss are still in doubt. Primary absorption (Phase III) is not dealt with in this paper.

Throughout the experiment the sap of *Nitella* exhibits ion concentrations below those in the protoplasm, and changes in ion content occur later than the corresponding changes in the protoplasm. It is apparent that ions may diffuse into the sap vacuole from the protoplasm when they have been accumulated by that protoplasm. This sap is merely an indirect reflection of protoplasmic processes. The protoplasm is the primary factor in ion accumulation, and is the seat of the metabolism concerned.

REFERENCES

- BROOKS, S. C., 1929. *Protoplasma* 8: 389-412.
— 1938a. *Jour. Cellular Comp. Physiol.* 11: 247-252.
— 1938b. *Proc. Soc. Exptl. Biol. Med.* 38: 856-858.
LUNDEGÅRDH, H., 1933 (with BURSTRÖM, H.). *Biochem. Zeit.* 261: 235-251.
OSTERHOUT, W. J. V., 1926. *Proc. Soc. Exptl. Biol. Med.* 24: 234-237.
STEWART, F. C., 1933. *Protoplasma* 8: 208-242.
— 1937. *Trans. Faraday Soc.* 33: 1006-1016.

ERNEST W. BROWN,† Yale University, and W. J. ECKERT,
Columbia University

Grant No. 204 (1938). The transformation of the rectangular coordinates of the moon into polar coordinates.

The tables of E. W. Brown which are now universally used in computing the position of the moon were obtained in three steps: (a) the determination of the coefficients in the harmonic series which give the rectangular coordinates in terms of the time; (b) the conversion of these series into similar ones giving the polar coordinates; (c) the tabulation of these latter quantities to simplify the evaluation of the coordinates for a given date. Parts (a) and (b) involved long and intricate calculations and therefore contained possible errors.

With the aid of the computing laboratory developed by Mr. Eckert it is now possible to verify and extend the calculation of parts (a) and (b) automatically by means of punched cards.

Preliminary results obtained last spring showed that Professor Brown's results for the rectangular coordinates were practically correct. The machine work of this verification is now completed and final results will soon be published in detail.

The conversion to polar coordinates is being carried forward as rapidly as the general program of the laboratory will permit, and is now over half completed.

BROWN, E. W., 1938. The Equations of Motion of the Moon. *Amer. Jour. Math.* 60: 785-792

JOHN T. BUCHHOLZ, University of Illinois

Grant No. 200 (1937). Study of the effects of physiological treatment of plants and cut flowers on pollen-tube growth in interspecific pollinations between certain species of *Datura*.

This investigation was carried out in the laboratories of the Department of Genetics of the Carnegie Institution of Washington at Cold Spring Harbor, New York, and has been continued with the assistance of an allotment from the N. Y. A. fund at the University of Illinois. The investigations, which were carried out on a larger scale than indicated in my original application, may be summarized under four headings: (1) The effect of chemical sub-

† Deceased July 22, 1938.

stances on pollen-tube growth, (2) The effect of temperature on pollen-tube growth, (3) Pollen-tube growth in reciprocal crosses between the tetraploids and diploids of various species of *Datura*, and (4) The chromosomal localization of the genes affecting pollen-tube growth. All of these investigations are in collaboration with Dr. A. F. Blakeslee.

1. In my study of the possible effects from the use of various chemical substances on pollen-tube growth, we have thus far met with negative results. We have tested the flower styles with the flowers immersed in various types of chemicals in different concentrations, with appreciable decreases in the growth of the pollen-tubes in some instances, but have found no substance that distinctly stimulates this growth process. The growth-promoting substances such as Indol Butyric acid do not stimulate pollen-tube growth when used as indicated above.

2. In my study of the effect of temperature on pollen-tube growth I have repeated some of our earlier experiments and obtained results similar to those obtained previously with *Datura stramonium*. These tests were made in order to find whether the increase in growth rate with any given increase in temperature that was observed in *Datura stramonium*¹ is paralleled in the other species of *Datura*. In *Datura innoxia*, which has a much higher growth rate at 19° C than *D. stramonium*, I have found correspondingly higher growth rate at 12° C, 20° C, 28° C, and above 30° C, so that the rate curves do not intersect but lie parallel to each other. Similar preliminary temperature tests were also made on other species, *D. discolor*, and in a cross pollination *D. stramonium* × *D. meteloides*.

3. In the studies on pollen-tube growth in reciprocal pollinations between the tetraploids and diploids of various species of *Datura* some definite and somewhat surprising results were obtained. In *Datura stramonium*, it was previously found² that the crosses:

4n × 4n give poor pollen-tube growth.

4n × 2n give satisfactory pollen-tube growth.

¹ Buchholz, J. T., and A. F. Blakeslee. Pollen-tube growth at various temperatures. Amer. Jour. Bot. 14: 358-369. 1927.

² Buchholz, J. T., and A. F. Blakeslee. Pollen-tube growth in crosses between chromosomal types of *Datura stramonium*. Genetics 14: 538-568. 1929.

2n × 4n give very unsatisfactory pollen-tube growth.

2n × 2n give very satisfactory pollen-tube growth.

I can now report that in *Datura innoxia*

4n × 4n is not as good as for *D. stramonium*.

4n × 2n (flowers not obtained).

2n × 4n is better than that obtained for *D. stramonium*.

2n × 2n is about as expected and previously obtained.³

In *Datura ceratacaula*

4n × 4n is nearly the same as for *D. stramonium*.

4n × 2n is not as good as for *D. stramonium*.

2n × 4n is better than in *D. stramonium*.

2n × 2n is excellent, better than in *Datura stramonium*.³

In *Datura ferox*

4n × 4n is slightly better than for *D. stramonium*.

4n × 2n is not as good as for *D. stramonium*.

2n × 4n is better than that obtained for *D. stramonium*.

2n × 2n is about as expected and previously obtained.³

In *Datura pruinosa*

4n × 4n is not as good as for *D. stramonium*.

4n × 2n is not as good as for *D. stramonium*.

2n × 4n is better than that obtained for *D. stramonium*.

2n × 2n is about as expected and previously obtained.³

From this it appears that the behavior of pollen-tubes in crosses between the tetraploids and diploids differs from species to species within the genus.

4. In the investigations which have been in progress for a number of years on the chromosomal localization of the genes affecting pollen-tube growth in *Datura stramonium*, some of which have been described,⁴ we succeeded this summer in practically completing the project. By the continued use of the same genetic methods, it was found that the gene *s-1* is located on the 19·20 chromosome, that the gene *lp* is on the 11·12 chromosome, that the gene *sb-3* is on the 15·16 chromosome, that the gene *sb-1* is probably on the 15·16 chromosome and that the gene *sl-2* is on the 5·6 chromosome. For several of these genes we have secured direct confirmation of

³ Buchholz, J. T., L. F. Williams, and A. F. Blakeslee. Pollen-tube growth in ten species of *Datura* in interspecific pollinations. *Proc. Nat. Acad. Sci.* 21: 651-656. 1935.

⁴ Buchholz, J. T., and A. F. Blakeslee. Genes from Radium treatment affecting pollen-tube growth in *Datura*. *Genetics* 21: 731-751. 1936.

the linkage effects with other genes known to be located on the same chromosomes. For *sl-2* this linkage was demonstrated with two other genes of the kind which cause pollen abortion—*pa* genes. This last-named linkage has presented a very unusual genetic situation making the recognition and estimation of linkage visible directly in the gametophyte generation on a single microscopic slide, and was demonstrated at the Woods Hole meeting of the Genetics Society of America.¹

The grant received from the American Philosophical Society was used in payment of three assistants at Cold Spring Harbor, New York, during the months of July, August, and September—Mr. Kenneth Retherford, Miss Geraldine Moon, and Miss Ruth E. Buchholz.

H. O. BURDICK, Alfred University

Grants No. 124 (1936) and No. 227 (1938). Studies of the physiology of the fallopian tubes.

In our earlier work supported by a grant-in-aid from the Penrose Fund it had been shown that massive doses of the estrogenic hormone Progynon-B caused fertilized eggs of mice and rabbits to pass through the fallopian tubes 30 to 40 hours quicker than the ova in normal animals, in which the passage requires approximately 72 hours. Pregnancy is prevented because these accelerated ova degenerate.

It was not known whether these massive doses of Progynon-B, causing acceleration of the ova acted directly on the fallopian tubes or indirectly through an excessively stimulated ovary. Our experiments now show that the ovary is not an agent in acceleration but is necessary in normal animals to complete the tubal journey to the uterus. Eggs in uninjected mice, ovariectomized several hours after mating, are tube-locked; that is, they do not descend into the uterus. In mice receiving 200 rat units of Progynon-B after ovariectomy, the eggs were usually accelerated in their normal rate of tubal passage to the uterus. It is now thought that this hormone acts directly on the fallopian tubes but other possible factors such as the pituitary have not been eliminated.

Work has been completed on the photography of eggs within the fallopian tubes, showing them in several regions from the infundi-

¹Buchholz, J. T., and A. F. Blakeslee. Records Genetics Society of America for 1938: 95-96. 1938.

bulum to the uterus. These pictures, together with direct observations on tubal activity, will add materially to our knowledge of the transport of ova.

The following experiments are in progress:

1. The effects of male hormone (testosterone propionate) on early pregnancy (almost completed).
2. The effects of this same hormone on the oviducts, tubo-uterine junction and fertilized ova.
3. Experiments similar to (2) using small and massive injections of an estrogen; also using progesterone, the corpus luteum hormone.

- BURDICK, H. O., 1938. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1937: 225-226.
- 1938 (with WHITNEY, RAE). Fate of Ova Accelerated in Their Rate of Passage Through the Fallopian Tubes of Mice by Massive Injections of Progynon-B¹. *Endocrinology* 22: 631-638.
- 1938. Acceleration of the Rate of Passage of Fertilized Ova Through the Fallopian Tubes of Rabbits by Massive Injections of Progynon-B¹. *Endocrinology* 22: 639-642.
- 1938. The Effect of Massive Doses of an Estrogen on Ova Transport in Ovariectomized Mice. *Endocrinology* 24: 45-49.

MILLAR BURROWS AND NELSON GLUECK, American Schools of Oriental Research

Grant No. 175 (1937). Preliminary excavations at Tell el-Kheleifeh, a small mound in southern Transjordan, just outside Aqabah.

The archaeological survey of Transjordan by Nelson Glueck, Director of the American Schools of Oriental Research at Jerusalem, showed that there was extensive copper mining and smelting in the Arabah during the Early Iron Age. This recalled the biblical account of commercial activities under Solomon, including the establishment of a seaport at Ezion-Geber. Preliminary soundings were promising, and the American Philosophical Society awarded a grant for excavation, which Glueck carried on during March, April, and May, 1938.

Remains of mud-brick buildings belonging to four periods of occupation, from the tenth to the seventh or sixth century B.C., were uncovered, including an elaborate copper refining plant, with extraordinary flues and drafts. Small finds indicate that the

manufacture of copper and iron implements was practised also. Imported objects attest the active commerce by ship and caravan for which this port was a center. Further witness of commercial relations is borne by a jar inscribed with South Arabian characters. An Edomite graffito on a jug and eleven impressions of the seal of "Qaus-anal, servant of the king," on jar-handles of the seventh or sixth century B.C., were found.

The pottery, while related to that of the Early Iron Age in Palestine and more closely to the Edomite pottery hitherto found in Transjordan, is in some respects distinctive. Ledge and horn handles, not elsewhere found in this period, are especially characteristic.

About two thirds of the mound, including the highest part, remain to be excavated. A second campaign is planned for next spring, if possible.

GLUECK, NELSON, 1938. King Solomon's Naval Base at Ezion-Geber. Illustrated London News, July 30, 1938: 212.

—— 1938. The First Campaign at Tell el-Kheleifeh (Ezion-Geber). Bulletin Amer. Schools Orient. Res. 71: 3-18.

—— Ezion-Geber: Elath. Bulletin Amer. Schools Orient. Res. 72: 2.

—— 1938. Ezion-Geber: Solomon's Naval Base on the Red Sea. Biblical Archaeologist 1: 13-16.

—— 1938. King Solomon Appears in a New Role. N. Y. Times Mag., Sept. 18, 1938: 14.

—— 1938. Solomon made a Fleet of Ships. Hadassah Newsletter, October 1938: 13-14.

DWIGHT CLARK CARPENTER, New York State Experiment Station

Grant No. 222 (1938). Effect of ultraviolet light on proteins and amino acids.

Results of certain other workers have shown that stearylamine $C_{17}H_{35}NHCO(CH_2)_{16}CH_3$ undergoes photolysis when exposed to light as a mono-layer giving aniline and stearic acid. As the $-NHCO-$ group is the common peptide linkage in proteins, one might expect at first sight that the stearylamine experiment would apply directly to the problem of splitting proteins by light; however in the amino acids, the side chain carrying the benzene ring or other light absorbing groups is attached through a CH_2 group to the alpha carbon atom of the acid. This means that the absorbed light quanta must travel from the ring through two CH_2 groups before it may activate the NH_2 group and cause a reaction.

To test the possibility of such energy transfer from the ring to the chain, benzyl stearyl amine $C_6H_5CH_2NHCO(CH_2)_{16}CH_3$, and β -phenyl-ethyl stearyl amine $C_6H_5(CH_2)_2NHCO(CH_2)_{16}CH_3$ have been prepared and exposed as mono-layers on normal hydrochloric acid solution to ultraviolet light of wave-length 2480 and 2537 Å through filters. Preliminary experiments show that the photolysis of each compound is easily demonstrated in the properties of the film and by the reaction products. It is therefore to be expected that the peptide chains of proteins may be split at places where light-absorbing side-chains occur in the molecule. By irradiating a protein with a suitable wave-length of light, splitting can presumably be directed to points in the peptide chain adjacent to a side-chain carrying a given light-absorbing group.

CARPENTER, D. C., 1938. Splitting Proteins by Ultraviolet Light. Science. (In press.)

EDWIN F. CARPENTER, Steward Observatory, University of Arizona
Grant No. 216 (1938). The distribution of color-index in the extragalactic nebulae.

With the support of a grant from the American Philosophical Society, additional photometric apparatus, especially suitable for the photographic colorimetry of nebulae, has been obtained. The principal portion of the apparatus was received from Holland in June, and during the fall modifications have been made, chiefly experimentally, to adapt it to the problem in hand. Grateful acknowledgment is made to the Spencer Lens Company for the donation of a mechanical stage of obsolete model which is adaptable to the photometer with virtually none of the extensive changes which would be required by any of the current models.

The thermopile of the type which is commonly used as the sensitive receiver in this kind of photographic photometry was found to be impracticably sluggish, in view of the rather large number of densitometric tracings which must be made in rather rapid succession for this problem, and, after careful tests, it has been successfully replaced with a photovoltaic cell which is sold under the trade-name "Electrocell." One of these cells has been selected which is more sensitive than the original thermopile, has almost instantaneous response, and, under the faint illumination in the photometer (which gives rise to a maximum current of 0.8 micro-

ampere), is without detectable fatigue. The responses of this cell are reproducible with precision.

Through the courtesy of Professor Harlow Shapley, the grantee used, during part of the summer, the universal tracing densitometer of the Harvard Observatory to derive the blue and yellow isophots of the early type, edgewise spiral nebula N.G.C. 4594. Quantitative reductions of the isophots are still in progress, but it can be stated in a preliminary way that the blueness of the nebula increases with distance from the center in a very evident manner. Observational material is being extended with the thirty-six inch reflector of the Steward Observatory.

FRANK M. CARPENTER, Harvard University

Grant No. 188 (1937). The study of types of Carboniferous insects from the Commeny shales contained in the Museum of Natural History at Paris and other European Museums.

The study was made during the months of June to August 1938. The grant was used to cover part of the expenses of travel and equipment needed for the investigation. Drawings and photographs were made of all the types (240) of the Commeny insects, and a revision of the fauna is now being prepared. Publication of the results will be made during the following year, presumably in the Proceedings of the Geological Society of America.

EDWARD F. CASTETTER, University of New Mexico

Grant No. 194 (1938). Investigation of primitive Indian agriculture in the Southwest.

During the past year a preliminary survey of the primitive agriculture of the Mohave, Yuma, Cocopa, Maricopa, Papago, Pima, and a number of Pueblo Indian groups, was made by Edward F. Castetter and W. H. Bell. The Pueblo peoples studied were Taos, Picuris, San Juan, Santa Clara, San Il de Fonso, Nambe, Cochiti, San Felipe, Santa Ana, Sandia, Jemez, Isleta, Acoma, Laguna, and Zuni.

The study involved the technique of primitive agriculture—methods of seed selection, planting, cultivating, irrigating, guarding against fungi and insects, harvesting, and storing the crop; also primitive agricultural implements. Moreover the kinds of crops grown and varieties of each were investigated.

It was found that the crops grown anciently in the Southwest were maize, beans, pumpkins, cotton, tobacco, and gourd. In addition, the Colorado River tribes sowed several species of grasses. The varieties of corn and beans grown varied in different parts of the Southwest. The Pueblo peoples had a much larger number of varieties of maize than those of the Colorado and Gila Rivers, who had only four—yellow, blue, white, and speckled. All primitive corn in the Southwest was of the flour type. Only one species of pumpkin seems to have been grown aboriginally—*Cucurbita moschata*. The varieties of beans, cotton, and tobacco which were grown are being investigated.

It was soon learned that practical southwestern primitive agriculture could not be adequately investigated without simultaneously looking into the related agricultural ritual, since the practical and ceremonial aspects of Indian agriculture are here inseparable.

The grant was made to cover a two year period. The first year has been spent in a survey of the entire southwestern picture as regards primitive agriculture. Many contacts had to be made, as among the Pueblo Indians particularly, the information is very difficult to obtain because of their secrecy. We now know where the most promising and fruitful places of attack are located; where it will or will not be profitable to pursue the inquiry further.

ALFRED CHANUTIN, University of Virginia

Grant No. 146 (1937). Study of renal insufficiency as produced by partial nephrectomy.

During a study to determine the effect of yeast-containing diets on kidney hypertrophy in intact and partially nephrectomized rats, it was noted that the livers of some of the intact animals showed gross fatty changes, while the livers of partially nephrectomized rats appeared normal. The following observations were made on these animals.

The total fatty acids and free and esterified cholesterol concentrations have been determined in the livers of intact and partially nephrectomized rats fed diets containing varying percentages of dried yeast (20, 30, 40, 60 and 80 per cent). Intact rats develop fatty livers on these diets. The fatty acid concentration decreases progressively as the yeast content increases. The livers of the partially nephrectomized rats showed no fatty changes on the yeast

diets. These experiments show that renal insufficiency as produced by partial nephrectomy affects the lipid metabolism. No consistent changes were noted for the free and esterified cholesterol of the livers of intact rats on the various yeast diets.

This investigation was undertaken to study the effects of feeding diets containing varying concentrations of dried yeast on kidney hypertrophy, renal function and blood pressure in intact and partially nephrectomized rats.

Diets containing 20, 30, 40, 60 and 80 per cent yeast were fed to intact and partially nephrectomized rats. There were no changes in the $\frac{\text{surface area}}{\text{dry kidney weight}}$ ratios for the animals ingesting 20, 30 and 40 per cent yeast diets, but there was a relatively marked increase in the ratios for the 60 and 80 per cent diets, indicating that yeast contains substances capable of preventing hypertrophy within definite limits of protein intake. The $\frac{\text{urea ratio}}{\text{kidney weight}}$ ratios and the blood pressures were fairly constant for all diets. These observations have summarized the effects on the intact animals.

The following observations were made on the partially nephrectomized rats:

There was a progressive increase in the $\frac{\text{dry kidney weight}}{\text{surface area}}$ ratios with increasing concentrations of yeast in the diet. Yeast does not prevent kidney hypertrophy of the kidney remnant. The incidence of hypertension was greatest in the group ingesting 60 per cent yeast diet. There was no marked renal insufficiency in any of these animals, as judged by the urea clearances. Furthermore, the blood urea concentrations were not markedly elevated at the lower urea clearances.

CHANUTIN, ALFRED, 1938 (with HORTENSTINE, J. C., and LUDEWIG, STEPHAN). Influence of Yeast-containing Diets on the Total Fatty Acids and Cholesterol Content of the Livers of Intact and Partially Nephrectomized Rats. *Jour. Biol. Chem.* 125: 455-459.

— (with LUDEWIG, STEPHAN). Experimental Renal Insufficiency Produced by Partial Nephrectomy. XIV. Diets Containing Whole Dried Yeast. *Archives of Internal Med.* (in press).

ELIOT R. CLARK, University of Pennsylvania

Grants No. 185 (1937) and No. 275 (1938). Growth and behavior of cells, etc., as observed microscopically in the living mammal, with the aid of transparent chambers and windows.

The generous grant of the American Philosophical Society has made possible the continuation and branching out of an extensive research project the nature of which has consisted of the study, by microscopic observation, of the growth and activity of the individual tissue elements in the living mammal with the aid of permanently installed transparent chambers and windows. Previous to October 1937 the chief results had been:

1. The creation of a variety of standardized new methods.
2. (a) Extensive observations on the rate and manner of growth of new blood capillaries; on the differentiation of arteries, veins, companion veins, arterial and arterio-venous anastomoses; and on the structures involved in the control of peripheral circulation.
(b) Observations on the nature of endothelium in relation to variations in permeability and to the emigration of leucocytes.
3. New data regarding the rate, manner and conditions of growth of lymphatics, their relations to blood vessels and tissue spaces and their behavior under a variety of experimental conditions.
4. New observations on the behavior of various types of blood cells after emigrating from the blood vessels.
5. Studies on the tempo of growth and differentiation of nerves, connective tissue, cartilage, bone and fat cells.
6. (a) Transplantation of bone to the experimental ear chambers and microscopic observation of bone healing.
(b) Transplantation of thyroid follicles to the ear chamber and observation of the changes during thyroid activity.
7. (a) Reactions of blood vessels and other tissues to methylene blue, phosphates, urea, horse serum and carbon dioxide.
(b) Preliminary studies on the pH of intercellular substance.
8. Installation of chambers in the ears of dogs.
9. (a) Successful externalization in a celluloid chamber of a loop of intestine.
(b) Permanent installation of a celluloid window in the skull, making possible long-continued studies of pial circulation.

The research activities during the year October 1937–October 1938, made possible by the grant from the American Philosophical Society, are briefly as follows:

Dr. E. R. Clark and Mrs. E. L. Clark have continued almost daily microscopic observations of living cells, adding to previous data, particularly on the growth and behavior of epidermis in a confined space; on the behavior of blood and lymphatic capillaries; of giant cells and of macrophages marked by phagocytized carmine particles; and have carried out preliminary experiments with a vital dye (Eastman Kodak "T. 1824") in a study of the permeability of blood and lymphatic endothelium.

Dr. R. G. Williams has continued his microscopic studies on living, functioning thyroid follicles transplanted to the ear chamber, adding a number of interesting observations to previous data.

Dr. R. G. Abell has continued active work along several lines, using the "chemical" or "moat" chamber. With Dr. H. P. Schenck he has extended his studies of the anaphylactic reaction; with Dr. Clark he has started a study of the pH of intercellular substance by using the indicator in the living animal; he is securing data regarding the rate of extravascular accumulation of nitrogen-containing substances—all designed to shed light on the nature and behavior of endothelium and of the intercellular substance. He is also preparing for publication the results of earlier studies on the reactions of blood capillaries to urea, and, with Dr. Aylward, on the reactions of endothelium to testicular extract.

Dr. E. A. Swenson has secured motion picture records, with Dr. Williams, of the activity of living thyroid follicles, and with Dr. Schenck and Dr. Abell, of the behavior of blood vessels during the anaphylactic reaction.

Dr. Mary L. Stearns, Fellow in Anatomy, has completed a four-year study of the growth and differentiation of connective tissue, and, as recipient of a Finney-Howell Fellowship (since July 1, 1938), has commenced a study of the reactions of tissues to carcinogenic substances.

Dr. Max Samter, as Guest Fellow (since October 1, 1938), has commenced studies on certain phases of the anaphylactic reaction.

Preliminary attempts have been made to extend the transparent window technic to other parts of the animal—Mr. McClenahan and Dr. Zintel to the lung, Mr. Wise to the bone marrow, and Mr. Talbot to the liver.

During the year Dr. T. H. Seldon, of the Mayo Clinic, has been shown the technic of installing chambers, in order that he might study the effects of certain anesthetics on endothelium; assistance has been given to Dr. W. Penfield of Montreal in connection with the installation of "cranial" chambers; and new copies of four reels of motion picture films have been supplied to the Council on Physical Therapy of the American Medical Association, loan collection.

- CLARK, E. R., 1938. Arterio-venous Anastomoses. *Physiol. Rev.* 18: 229-247.
- 1938. Certain Aspects of the Behavior of Peripheral Blood Vessels, as Observed Microscopically in the Living Mammal. George Brown Memorial Lecture. *Amer. Heart Jour.* (To be published in part.)
- 1937 (with CLARK, E. L.). Observations on Isolated Lymphatic Capillaries in the Living Mammal. *Amer. Jour. Anat.* 62: 59-92.
- 1938 (with WENSTLER, N. E.). Pial Circulation Studied by Long-continued Direct Inspection. *Proc. Assoc. for Res. in Nerv. and Ment. Dis.* 28: 218-228.
- WILLIAMS, R. G., 1937. Microscopic Studies of Living Thyroid Follicles Implanted in Chambers Installed in the Rabbit's Ear. *Amer. Jour. Anat.* 62: 1-29.
- ABELL, R. G., 1938 (with SCHENCK, H. P.). Microscopic Observations on the Behavior of Living Blood Vessels of the Rabbit During the Reaction of Anaphylaxis. *Jour. Immunol.* 34: 195-213.

RALPH E. CLELAND, Indiana University

Grants No. 134 (1937) and No. 202 (1938). Taxonomic and cytogenetic survey of *Oenothera*, sub-genus *Onagra*.

In the YEAR BOOK for 1937 (pp. 142-146) a general picture of the cytogenetic and phylogenetic situation in *Oenothera* was outlined. The work of the present calendar year has been devoted in part to filling in details of the picture and in part to extending the range of the investigation.

To date, considerably over 100 distinct races of *Oenothera* have been grown and examined cytologically. It is obviously impossible with the facilities at hand to make a detailed study of all of these types; consequently, certain forms which are representative of the various classes of phenotypes have been selected for detailed analysis. During the current year progress has been made in the analysis of the segmental arrangements of the following races:

"*biennis*" types—Waterbury (Vt.), Friendship (Ind.), Hopkinsville (Ky.), Hot Springs (Ark), Magnolia (Ky.), Warrenton (Va.), La Crosse (Va.)

Rydbergii—Brighton (Colo.), Loveland (Colo.)

irrigua—Albuquerque (N. M.), Las Cruces (N. M.), Sandoval (N. M.)

Possible relatives of argillicola—Charlottesville (Va.), White Top (Va.)

Relationships in respect to segmental arrangement between complexes of the above and standard complexes have been found as follows:

α *biennis* *Waterbury* shows a close relationship to *acuens* and a fairly close relationship to *flavens*, *hookeri* and the β complexes of Iowa 1, Iowa 2 and Iowa 12.

α *Friendship* shows a close relationship to *acuens* and *franciscana* Sh. β *Friendship* is farther removed from these but shows a closer relationship to *flavens* than to any others with which it has been tested.

β *Hopkinsville* shows a rather distant relationship to the complexes of the California group.

α *Hot Springs* belongs quite definitely to the California group of complexes, being closest to *franciscana* Sh. in segmental arrangement.

β *Hot Springs* shows little relationship to any of the complexes with which it has been tested.

β *Magnolia* has as yet shown no evidence of relationship to other complexes, and the same holds true for β *Warrenton*.

α *La Crosse* shows some affinity with *franciscana* Sh.

In general, races of the *biennis* type have been found to have α complexes which show more or less relationship in segmental arrangement to the California complexes, and β complexes which show little or no relationship to these or any other complexes. For the most part, α complexes are transmitted through the egg and β complexes through the sperm, although α *Hot Springs* is transmitted also through the sperm. It is also interesting to note that the α complexes of *biennis* forms have so far all been characterized by broad leaves, whereas the β complexes have been narrow-leaved complexes (first noted by Dr. Hammond).

Rydbergii *Brighton* shows some degree of relationship to the California complexes in the case of both the α and β complexes. α *Rydbergii* *Loveland* shows a similar condition, but the β complex of this race has not as yet been studied. Indications are that the *Rydbergiis* will fall into the same class from the standpoint of

segmental arrangement as the strigosas, in which both complexes seem to be moderately related to the California group, but related from different sides, so that the α and β complexes of a given race show little relationship to each other.

The *irriguas* are unique in having chromosome configurations intermediate between large circles and pairs. Their complexes are closely related to those of the California group and are free of lethals. The segmental arrangements of *Las Cruces* have been worked out completely on the basis of tentative formulae for *gaudens* and *elongans*.

Charlottesville and *White Top* are narrow-leaved types which seem phenotypically to have affinities to *argillicola* and also to the *laevigatas*. In both cases, it is the β complex which, on the basis of phenotypic characters, would seem to be the more closely related to *argillicola*, and in both cases these also show a moderate degree of relationship in segmental arrangement to *argillicola*. The α complex of *Charlottesville* shows as yet little relationship to any complex, but a *White Top* is fairly closely related to the California group.

In addition to the above races, a number of others are in process of study, but it is too early at the present writing to make any statement with regard to their relationships.

Our study, which has been confined hitherto to forms found in the United States, is being at present extended to cover races in Central and South America. Last summer, a number of forms from Mexico were grown for the first time. These were collected in 1937 by Dr. P. A. Munz. Dr. Munz has this year received a Guggenheim Fellowship and is at present in South America, collecting material for this study. The South American *Onagras* are entirely unknown cytogenetically and the results of our examination of these will be awaited with deep interest.

One manuscript has been completed during the year, but is being withheld until additional data are secured with which to check the accuracy of some of the conclusions. Certain phases of the work were presented at the 1938 Annual Meeting of the Society.

In conclusion, I wish to express my great appreciation of the assistance which the American Philosophical Society, through the Penrose Fund, has so generously afforded this work.

HAROLD S. COLTON, Museum of Northern Arizona

Grant No. 226 (1938). Archaeological excavations of several small prehistoric sites belonging to the Patayan Culture in Northwestern Arizona.

Some archaeologists on the basis of surveys recognize four basic cultures in the Southwestern United States. In the culture which we are now calling Patayan, whose center lies in the Colorado River Valley below Boulder Dam, little or no excavation has been undertaken. Northwestern Arizona has been a blank place on the archaeological map.

During the past year a study of Patayan subcultures has been made a major project at the Museum of Northern Arizona and the Cohonina branch of the Patayan Culture was made the object of intensive study. Previous to this summer no sites had ever been excavated where the Cohonina branch was not confused by the cultures of neighboring regions.

Early in June 1938, the Museum of Northern Arizona established a camp seven miles north of Williams, Arizona, with a party composed of Lyndon Lane Hargrave, field director of the Museum, Milton A. Wetherill, foreman, Walter P. Taylor, and Albert H. Schroeder, assistant archaeologists, Robert Solenberger, student, George Petersen, cook, and two Hopi Indian laborers. The party was in the field two months.

The expedition was financed by a generous grant from the Penrose Fund of the American Philosophical Society and supplemented by funds of the Museum of Northern Arizona which supplied the salary of Mr. Hargrave, the use of a car and a trailer, camp equipment, including several portable houses, as well as miscellaneous laboratory supplies.

The expedition excavated a large masonry fort and seventeen earth lodge sites. Although the material from these excavations has not yet been studied in detail enough information is at hand to show the relationships of the Cohonina Branch to neighboring cultures. It is evident that the Cohonina had quite different cultural traits from the Hohokam of the south and the Pueblos to the east. A relationship is suggested to the people of the valley of the Colorado River to the west.

The Cohonina lived a semi-sedentary life, part agricultural and part food gathering. Their homes were surface structures built of

perishable materials, earth lodges, the detailed architecture of which is difficult to trace. Much charcoal was collected, because nearly every home had been burned. So far Mr. John C. McGregor, Curator of Dendrochronology, Museum of Northern Arizona, has been unable to date the charcoal by the Tree Ring method. There is some hope that by further study dates may be assigned. However, by cross finds of pottery we know that the sites were occupied between 700 A.D. and 1100 A.D. A "fort" with massive masonry walls belongs to the later period of occupancy. We found that the Cohonina people used a special projectile point to which has been given the name "Cohonina Point." The people used very few ornaments, none of shell. Their pottery belonged to the San Francisco Mountain Gray Ware. By studying the distribution of sites on the surface of which fragments of this ware predominate, we know the distribution of the Cohonina Branch. They occupied the area lying between the Little Colorado River on the east and the escarpment of the plateau on the west and from the Grand Canyon on the north to the San Francisco Mountain volcanic field on the south.

There is no evidence among these people of their burial customs.

Of twenty-one cultural traits listed in the preliminary report six were Puebloan and three Hohokam, the rest indicated that the culture may be related to that in the Valley of the Colorado River—a culture which we are calling Patayan, but as no excavation has yet been carried out in the valley of the Colorado River, the true relation of the Cohonina Branch must await further studies. As a result of the excavations at Williams, the Cohonina Branch of the Patayan Culture rests on a firm foundation.

HARGRAVE, LYNDON L., 1938. Results of a Study of the Cohonina Branch of the Patayan Culture in 1938 (Preliminary report). *Mus. Notes, Mus. Northern Ariz.* 11: 43-50.

FRED E. D'AMOUR, University of Denver

Grant No. 183 (1937). 1. Study of the time of ovulation in women as determined by tests of the urine for gonadotropic hormone. 2. Study of the nature of the gonadotropic hormone present in the urine of women at the presumed time of ovulation.

Grant No. 273 (1938). 3. Study of the hormonal balance during the menstrual cycle in its relation to ovulation and an investigation of indirect methods to determine the time of ovulation.

The first study has resulted in the following findings:

1. Day by day tests of the urine for gonadotropic hormone were made during 50 complete menstrual cycles. The tannic acid precipitation method was used. Positive responses were found as follows:

- a. During 3 cycles, no positive response.
- b. During 21 cycles, one positive response, falling between days 16 to 18.
- c. During 2 cycles, one positive response, falling on days 19 or 20.
- d. During 13 cycles, two positive responses, with a 6-12 day interval between.
- e. During 2 cycles, two responses, falling very close together.
- f. During 9 cycles, three responses at fairly regular intervals.

2. The conclusion drawn is that either ovulation occurs frequently, more than once during the menstrual cycle, or else that ovulation is not directly dependent upon hypophyseal stimulation.

This paper has been accepted for publication in the *American Journal of Obstetrics and Gynecology*.

The second study has not been completed. Results so far indicate:

1. That the gonadotropic hormone involved in ovulation resembles that produced by the anterior lobe of the hypophysis, that it is apparently identical in its properties with the substance found in menopausal urine but differs greatly from prolan, the substance found in the urine of pregnancy.

Sterility of hypophyseal origin should therefore be treated with hormones derived from the first two sources.

The third study has been in progress only a short time and no definite results can be reported.

FARRINGTON DANIELS AND R. M. DUGGAR, University of Wisconsin

Grants No. 24 (1934) and No. 59 (1935). Quantum efficiency of photosynthesis in *Chlorella*. To determine the quantum efficiency of the physiological processes when employing monochromatic light in different regions of the spectrum.

Practically the only quantitative work on the absolute quantum efficiency of this photosynthetic process has been done by Warburg and Negelein. They reported a quantum efficiency of practically

0.25 molecule of carbon dioxide per quantum (after making slight corrections for absorption by carotinoid pigments) at wave lengths of 6600, 5780, 5461 and 4360 Å. This value, which is close to the theoretical maximum, has been universally accepted.

The present work was undertaken, originally, for the purpose of extending the measurements of quantum efficiency to conditions more nearly approximating those found in a natural environment. However, even under the most favorable conditions the efficiencies were actually found to be much less than 0.25; consequently many experiments were performed in the effort to obtain higher efficiencies or to find an explanation for the lack of agreement between the earlier work elsewhere and our present study.

It is to be noted particularly that a variety of methods and procedures were followed in the determinations which we have reported and they were all in agreement in giving quantum efficiencies much lower than the value found by Warburg and Negelein. The measurements have extended over a period of five years, making it very improbable that a temporary physiological condition of the algae was responsible for the low results. During the course of these measurements two different monochromators and three different thermopile-galvanometer combinations, each independently calibrated, have been employed. Experiments using monochromatic and polychromatic light, and using constant and intermittent methods of gas flow, as well as experiments in closed reaction vessels, all have given results in approximate agreement.

Using monochromatic and polychromatic light of relatively low intensity, the quantum efficiency of photosynthesis in *Chlorella pyrenoidosa* was determined as approximately 0.05 molecule per quantum, which is considerably smaller than the value now generally accepted.

- MANNING, W. M., 1938 (with STAUFFER, J. F., DUGGAR, B. M., and DANIELS, FARRINGTON). Quantum Efficiency of Photosynthesis in *Chlorella*. Jour. Amer. Chem. Soc. 60: 266-274.
- 1938 (with JUDAY, C., and WOLF, MICHAEL). Photosynthesis in *Chlorella*. Quantum Efficiency and Rate Measurements in Sunlight. Jour. Amer. Chem. Soc. 60: 274-278.

JOHN H. DAVIS, JR., Southwestern College, Tennessee

Grants No. 143 (1937) and No. 215 (1938). The rôle of mangrove vegetation in land building in southern Florida.

Mangrove swamps cover much of the low-lying coasts and islands of southern Florida. Their peculiar root systems make it possible for them to grow in soft soils and survive the floodings of the inter-tide zone. They are able to migrate by means of floating viviparous seeds and can become established on shoals or shallow places offshore, thus starting new swamps. Their roots form such a tangled growth that they aid in causing deposition of soil forming materials that settle out of the slack waters. There is good evidence that they thus facilitate land building processes.

Clear evidence of this rôle of mangroves was obtained by comparing the land areas of old surveys with those of recent ones and then visiting some of these areas to observe the vegetational zones and the soil accretions. Many new swamp areas have developed in and about the shallow water basins. Other formerly submerged swamps seem to have built up soils above the usual high tide level. Although the accretion processes are slow the maps and field observations show appreciable land area increases in the last forty years.

A mangrove swamp develops from open water to an upland, non-flooded forest through a sequence of distinct communities that form fairly definite zones. The pioneer community of red mangroves, *Rhizophora mangle*, starts a new swamp, or extends an old one outward. Organic debris, and inorganic sands and muds, accumulate about the roots until the swamp is less deeply flooded. The black mangrove, *Avicennia nitida*, with a number of typical salt marsh plants, then forms a broad shallow-water swamp zone. The inner margin of this zone may be entirely above normal high tide. The buttonwood, *Conocarpus erecta*, a few white mangroves, *Laguncularia racemosa*, and some of the more inland plants occur as a transition zone between the black mangrove swamp and the non-halophytic types of vegetation; which may be sub-tropical hardwoods, pinelands, strand vegetation, or fresh water marshes. These zones constitute a plant succession—a halosere from open salt water and submerged marine aquatics to some inland, upland, type of vegetation.

The soils of these successive zones are indicative of accretion processes. Mangroves form abundant peat deposits that may

overlie, or be interbedded with, the primary coastal soils of marl, silicon sand, or calcareous sand. The plant remains accumulate to form the peat, which in some swamps is over twelve feet deep. Marl, sands, and shell fragments are washed in and settle out of the slack water. The mangrove roots reduce the water currents sufficiently to promote this sedimentation. There may be some chemical precipitation. The net result is a fairly definite increase of the soil level with advanced age of the swamp. Soil borings at over fifty localities showed in many instances significant stratification of these accumulations. Some instances of mangrove peat under hardwood forest soils, of black mangrove soils under buttonwoods, of red mangrove peat and marl under black mangrove soils, were found. However, the whole series of soils was seldom found in any one place.

The mangroves not only bring about these soil accretions but also aid by protecting the coast against erosion. Only the strong hurricanes can do them any material harm once the swamp is well established. Even then the hurricanes may wash in tons of soil materials among the roots and the new growth will start on top of this higher level. In the Cape Sable region some of the prairie-like marshes on thick marl deposits are underlain by mangrove peat. The marl was probably washed in and deposited by storms.

The effective spread of mangroves out from the coast, and even across many miles of ocean, is accomplished by their very efficient viviparous seeds. These unique seeds sprout roots while still attached to the parent tree, or develop them soon after dropping into the water. They are capable of floating great distances without losing their viability. When finally stranded they have roots already developed that soon attach them to the soils. The young seedlings can withstand alternate flooding and exposure, and a moderate amount of buffeting by waves. Studies of their rate and direction of dispersion have been made between Key West and the Tortugas Keys.

The survival and rate of growth of mangrove seedlings are being studied at a number of selected localities. Plantings have been made on many types of soil and where different depths of flooding occur. If successful some of these plantings may grow into a swamp and definite data can be obtained on progressive changes. A planting of over 4,000 red mangroves has been made on one of the coral fragment reefs of the Tortugas Keys to see if

these plants will survive and help build up a low island. It will take a number of years to observe the actual vegetational and soil changes at these experimental localities.

DAVIS, JOHN H., JR., 1938. Mangroves—Makers of Land. *Nature* 31: 551-553.

J. KENNETH DONAHUE, College of Charleston.

Grant No. 208 (1938). The occurrence of estrogenic substances in the ovaries of marine invertebrates.

In 1937¹ it was reported that the ovaries of the Bermuda echinoderm *Lytechinus variegatus* contained sufficient amounts of estrogenic substance to cause mature, ovariectomized female rats to come into estrus when injected with extracts of this material. The scope of this investigation has since been broadened to include studies of the ovaries of several other marine invertebrates.

During the past summer (1938) the gonads of four suitable Bermuda forms were collected in large numbers (*Stichopus mobii*, *Echinometria*, *Palinurus argus*, *Tripneustes esculentus*). In all cases the gonads were in a state of sexual maturity or were rapidly approaching that condition. Soon after collection the gonads were ground thoroughly in a mortar and treated with five times their volume of ethyl alcohol. They were taken to Charleston in that condition and in separate containers for each species. The method of extraction used for this material involves repeated extractions of the tissue with ethyl alcohol, acetone and ether, all of which have an affinity for fatty substances and the estrogenic hormone. The filtrates are reduced in volume by distillation under reduced pressure. The alcohol, acetone, and ether residues are combined. An equal amount of corn oil is added to the extract and the material is injected into ovariectomized rats in this form. At this time extracts of the gonads of *Stichopus mobii* have been prepared and extracts of the remaining material are in the process of preparation. The testing of these extracts will be carried out with the completion of all of the chemical work.

¹ Donahue, J. K., 1937. *Endocrinology* 21: 690-691.

FRANK G. DUNNINGTON, Rutgers University

Grant No. 198 (1937). A precision determination of the ratio of Planck's constant to the charge of the electron, that is, of h/e .

The work during this past year has been very largely constructional in nature, and has consisted, in part, in the resetting up here at Rutgers of the apparatus brought from the California Institute of Technology.

Since the uniformity of the earth's magnetic field and the absence of iron in the vicinity of the measuring chamber are of basic importance, a non-magnetic table and two platform extensions were built to hold the measuring apparatus and the two diffusion pumping systems respectively. The necessarily rather elaborate vacuum system has been installed. Magnetic considerations require the keeping of the fore pumps at some distance, hence a vacuum line some twenty feet long has been built. The construction and addition of several vacuum tight valves (in sizes up to three inches in diameter) has made a marked improvement in the vacuum system. Among other functions, these enable the measuring chamber to be opened without turning off the diffusion pumps, and they also prevent the diffusion of oil vapor into the measuring chamber when liquid air is not in the traps.

Construction and improvement of some of the other auxiliary equipment is in progress.

Further work with the apparatus has led to the conception of a variation of the original idea which it is believed would yield data much easier to analyze and interpret. If the present scheme does not prove successful with a reasonable amount of effort, the changes necessary for this alternative method will be considered.

M. B. EMENEAU, Yale University

Grants No. 73 (1935) and No. 125 (1936). Investigation of the Dravidian and Munda languages of India, especially those which, possessing no literatures in written form, have been relatively unexplored in a scientific way.

This project, which involved a stay of two years and eight months (October 1935 to May 1938) in India, was undertaken under the auspices of the Fund for Research in Language and Literature of Yale University and was carried on with the help of

the American Council of Learned Societies Devoted to Humanistic Studies during the first year (1935-6) and of the American Philosophical Society during the remainder of the time (1936-8). The length of time spent in India permitted residence in the areas where material was gathered to be taken up with an eye to optimum climatic conditions, but *per contra* makes difficult in a report an apportioning of activities between the periods during which aid was given by the two organizations. During the first year most of the time was given to a study of the Toda language, but work on this language and on the ethnology of the tribe was continued at intervals during the whole period in India; similarly, work on the Kota language was begun during a two-month period in the first year, but was continued and finished mainly during the last year in India. In the following report no attempt will be made to separate the two periods; a résumé of the total amount of work accomplished in India will be given.

Four languages were worked on—Toda, Kota, Coorg, and Kolami. All belong to the Dravidian stock. The last is spoken in Central India in the heart of a Marathi area (Indo-aryan), the first three in Southern India. None of these languages is written, and only in the case of Coorg had any pretentious grammar ever appeared; even this turned out to be remarkably incorrect in many ways.

Only six weeks could be spent on Kolami. This period yielded enough material to work out the sound-system accurately. The morphology of the language is also fairly completely covered. The most lamentable gap in the material is in syntax and vocabulary; this would have been remedied by working for a longer period and taking down a large number of texts in phonetic transcript. Unfortunately working and living conditions were not good, and the end of the stay in India was fairly near at hand when study of this language was begun.

Longer periods were spent on the other three languages. In all cases the material allows the sound-system, the morphology and the syntax to be worked out completely. Abundant vocabulary was collected, amounting to at least 5,000 words for each language. A large body of text material was also transcribed. The texts in the Coorg language comprise about 100 typewritten pages of prose and two long song-texts. In Kota there are about 1,000 manuscript

pages of text, nearly all prose; in Toda about 300 manuscript pages of prose and well over 300 song-texts.

The linguistic value of this study will be great. Even in the case of Kolami, on which least work was done, we for the first time have accurately recorded material for a grammar of a Dravidian language of the Central India geographic group. The Coorg language, adequately described on the basis of the material will be placed as an independent language lying genetically between Canarese on the one hand and Malayalam on the other (with affinities probably with Tulu also, for which we have not yet sufficient accurate material). Toda and Kota are probably of greatest interest to the Dravidian scholar. These two mutually unintelligible languages, spoken by two small castes who lived in isolation for many centuries on an almost inaccessible plateau, belong genetically between Canarese and Tamil, as they do geographically. Their isolation, however, has allowed them to develop in ways remarkably different from those in which Canarese and Tamil developed, especially in their phonology. Both Toda and Kota have lost all unaccented vowels of the other two languages, though there were slight differences in development between the two. Toda, moreover, has suffered a large number of phonetic shifts, including many conditioned shifts, with the result that it now has a much greater number of phonemes, both vowel and consonant, than any of the other three languages. Until all these phonetic laws have been worked out, it is impossible to place Toda really accurately or even to be sure that Toda and Kota are as closely connected as their common loss of unaccented vowels would seem to indicate. It is probable that the material gathered, when it has been worked up in descriptive grammars, will be sufficient for comparative grammatical work also.

The contents of the text materials are in general of a folk-tale nature. The Kota material especially is of great interest, since the Kotas are accomplished story-tellers and this activity plays a great part in their culture. The chief informant from this tribe was adept at dictating stories slowly enough so that they could be recorded in phonetic transcript, without losing his natural style. This material provides a fairly large corpus of South Indian folk-tales in an isolated region. The Toda song-texts are, I think, almost unparalleled as a record of lyric composition in a living oral technique. The two Coorg song-texts also belong to a living tech-

nique and, since they are long, furnish some indication of the details of the technique; to complete a study of Coorg oral poetry more texts would be necessary (it is hoped that an opportunity may be found later to collect more). A searching study of the poetic branch of art in unlettered communities still remains to be made. This South Indian material, it is thought, will be an essential part of the study when it is undertaken.

Ethnological work was necessary to elucidate the linguistic work. The Kotas were a previously untouched tribe with a complex culture; fortunately Dr. D. G. Mandelbaum of Yale University undertook this difficult piece of anthropological research. The Toda culture had been previously described in great detail by W. H. R. Rivers. Linguistic work led to some gaps being filled, and to one discovery of prime importance, viz. that the Todas are a community with dual descent, i.e. both patrilineal and matrilineal clans, a phenomenon that has been reported only rarely, though anthropologists are beginning to suspect that it occurs with more frequency than the reports would indicate. The new Toda material has led also to a reinterpretation of the religion of the tribe, and frequently allows one to place the emphasis on elements of the culture rather more truly than it had been done before. Work among the Coorgs also yielded some ethnological material, though no systematic study of their culture could be undertaken in competition with the linguistic work.

All the material, grammatical, textual, and ethnological, is being worked over and it is hoped that all will in time be published.

- EMENEAU, M. B., 1937. The Songs of the Todas. *Proc. Amer. Philos. Soc.* 77: 543-560.
- Ritual Games of the Kotas. *Bull. Sri Rama Varma Res. Inst.* 5: 114-122; 6: 1-6.
- 1938 Echo-words in Toda. *New Indian Antiquary* 1: 109-117.
- 1938. Personal Names of the Todas. *Amer. Anthropol.* 40: 205-223.
- 1938. Toda Culture Thirty-five Years After: An Acculturation Study. *Annals Bhandarkar Oriental Res. Inst.* 19: 101-121.
- 1938. An Echo-word Motif in Dravidian Folk-tales. *Jour. Amer. Oriental Soc.* 58: 553-570.
- Toda Menstruation Practices. Forthcoming in *New Indian Antiquary* (Dr. F. W. Thomas Festschrift).
- Kinship and Marriage Among the Coorgs. Forthcoming in *Jour. Royal Asiatic Soc. of Bengal*.

- The Vowels of the Badaga Language. Forthcoming in Language.
- Toda Kinship Terms and Dual Descent. Forthcoming, probably in Amer. Anthropol.

NABILI AMIN FARIS, Princeton University

Grants No. 84 (1935) and No. 209 (1938). Editing from old manuscripts and translating into English the *Ihyā' 'Ulūm al-Dīn* of al-Ghazzālī which treats of Moslem theology and jurisprudence, Moslem political theory and constitutional law.

(Abstract of paper read at General Meeting, November 19, 1938)

The *Ihyā' 'Ulūm al-Dīn* is the *magnum opus* of al-Ghazzālī, the greatest Moslem theologian after Muḥammad and one of the noblest and most original thinkers of all time. He may be likened to Thomas Aquinas whom he influenced, but his personal contribution to theology was more considerable than that of Aquinas. He also influenced Pascal and left his impress on Christian and Jewish scholasticism in general.

The *Ihyā' 'Ulūm al-Dīn* consists of four large volumes and contains more than a thousand closely transcribed manuscript pages of folio size. The first two volumes treat of the outward forms of worship, while the last two deal with inward nature of religion. In it al-Ghazzālī grafts mysticism onto Islam and establishes its orthodoxy. For this reason he has been called the St. Augustine of Islam. Through this book al-Ghazzālī led the Moslems back from scholastic labors upon theological dogmas and minutiae to living contact with the Word. Through it he insured for Sufism a firm and permanent position in the "Church" of Islam. Above all, through it he brought philosophy and philosophical theology within the range of the ordinary man. The unique position which it occupies among the Moslems is summed up by the words of Ḥājjī Khalīfah, the foremost Turkish writer of the seventeenth century, who said, "Should all other Moslem writings be destroyed, the *Ihyā'*, if spared, would make up for all the loss." Consequently, alongside of the ossified system of the traditionalists, the *Ihyā'* is earnestly studied; and in that study, without doubt, is the hope for the future of Islam.

ROBERT GAUNT, New York University

Grant No. 212 (1938). Study of the functional interrelationship of the adrenal cortex and the pituitary.

(The study of the rôle of progesterone and other sex hormones in the survival of pseudopregnant, adrenalectomized ferrets was carried out by Robert Gaunt and Harry W. Hays; that of cortical hormone-like action of progesterone on rats by Robert Gaunt, Warren O. Nelson and Eleanor Loomis.)

1. In 1928, Rogoff and Stewart made the enigmatic observation that female dogs adrenalectomized while in estrus remained in good health for varying periods up to two months. Adrenalectomized dogs usually die of adrenal insufficiency in about 7 days. Their discovery was subsequently confirmed and extended (Swingle *et al.*) but not explained.

A long (2 months) pseudopregnant or luteal period follows estrus spontaneously in the dog. Since estrus lasts only a few days, life was maintained largely during the luteal or pseudopregnant period. Attempts in our own and other laboratories to analyze this phenomenon, in various mammalian species, have involved experiments and results of the following types. First, attempts to see if estrogenic hormones would relieve adrenal insufficiency, showed the opposite to be true; adrenal insufficiency was precipitated. Second, corpus luteum hormone therapy was used in five laboratories and found to be non-toxic but of no value as a cortical hormone substitute. Third, attempts were made to show that life was maintained by some pituitary action, not directly related to the gonads, and were for the most part unsuccessful.

Because of the nature of its reproductive cycle, we used the ferret for further investigation of this problem. The ferret is non-spontaneously ovulating, and remains in estrus through the spring and summer months unless mated. After sterile mating, a pseudopregnant period of 6 weeks duration may be reliably induced. Thus it was possible to study the effects of estrus and pseudopregnancy on adrenalectomized animals under controlled conditions. The results, in brief, follow.

Spontaneous estrus in adrenalectomized animals precipitated adrenal insufficiency quickly, and to maintain life during estrus the routine maintenance dose of cortical extract had to be doubled at least. Estrus induced by gonadotropic hormone or estrin in-

jections had the same toxic effect. It was presumed, therefore, that the dog adrenalectomized during estrus lived not because of estrus but in spite of it, and only because that estrus was of short duration.

The results were quite different when the animals were made pseudopregnant, either by sterile mating after spontaneous estrus, or by the use of proper pituitary preparations during the non-breeding season. When made pseudopregnant, life was maintained without any cortical hormone for an average of 32 days in 12 cases. Ovariectomy in pseudopregnant animals showed that this maintenance of life was dependent upon the presence of luteinized ovaries.

The only pituitary extracts that would extend life were those which induced ovarian luteinization. It was concluded, therefore, that something secreted by the corpus luteum could substitute for the adrenal cortex and was, in all cases, responsible for the life-maintenance noted above. The known secretions of the corpus luteum are estrogenic hormones and progesterone. The former we had shown to be toxic and in other forms, at least, the latter substance had been found useless in adrenalectomized animals. We tentatively postulated that the corpus luteum secreted an unknown cortical hormone-like substance, just as the adrenal cortex can and does secrete sex hormones. Since no direct test of this hypothesis was found, we investigated again—despite previous failures in other species—the possibility that progesterone itself might be the life-maintaining agent.

Using large doses of 5 mgm. per day of progesterone we found, to our surprise, that this substance maintained excellent health, vigor, and appetite indefinitely in adrenalectomized ferrets. It worked equally well in castrate males or castrate females, showing that its action was not through the gonads. It was later found that the minimal effective dose was in the range of 2 mgm. per day.

It was clear, therefore, that progesterone has the peculiar ability to substitute for the adrenal cortical hormone, and that this fact can account for the survival of pseudopregnant adrenalectomized animals and of rats treated with gonadotropic preparations (experiments of Emery and Schwabe, and Cavanaugh and Gaunt). The entirely different effects of estrin and progesterone are surprising and unexplained.

The significance of this action of progesterone is not clear, but

the obvious indications are that the functions of this hormone extend beyond the reproductive tract.

Previous failures to note this cortical hormone-like action of progesterone were probably due to the use of inadequate dosage and of more refractory species.

Testosterone propionate, a substance chemically similar to progesterone, was non-beneficial to adrenalectomized ferrets, but unlike estrin, was non-toxic.

2. Gaunt and Hays found progesterone to be an effective cortical hormone substitute in adrenalectomized ferrets (above abstract). We have noted a similar, but weaker, action of progesterone in rats. One to two mgm. progesterone per day extended the life-span of 30-day-old adrenalectomized rats beyond that of untreated litter-mate controls. Twenty-two untreated controls died at an average of 7.5 days. Of 19 treated animals, 10 died during treatment at an average of 10.4 days and 9 survived during the treatment period of 20 days. Weight gains in treated animals were four times those of untreated controls. Failure to maintain life in all cases was probably due to inadequate dosage. On the basis of equivalent body weight it took 10 or more times as much progesterone to maintain adrenalectomized rats as ferrets. The need for such large dosage in this species probably accounts for the several previous failures to notice these cortical hormone-like effects of progesterone.

Progesterone (7.5 mgm.) failed, however, to act like cortical extract in protecting adrenalectomized rats against "water intoxication" symptoms following administration of excess quantities of water. Estrone and testosterone propionate were likewise without effect, despite their known action on electrolyte metabolism of intact animals. The failure of progesterone to act in acute tests of this type indicates some difference between the rate or type of its action and that of cortical hormone.

GAUNT, ROBERT, 1938 (with HAYS, HARRY W.). *Amer. Jour. Physiol.* 124: 767.
— 1938 (with NELSON, WARREN O., and LOOMIS, ELEANOR). *Proc. Soc. Exp. Biol. and Med.* November.

FRANK E. E. GERMANN, University of Colorado

Grant No. 249 (1938). Study of anomalous double refraction observed by Germann and Metz of solutions of certain inorganic salts in water to determine whether the effect is due to ions, or to molecules formed by hydrolysis.

In 1936 Germann and Metz (J. Colo. Wyo. Acad. Sc. Vol. II, Nos. 2 and 3, p. 60, 1937) observed an abnormal behavior in aqueous solutions of the acetates of calcium, cadmium, sodium and potassium. These solutions exhibited an abnormally large magnetic double refraction at concentrations of 0.2 to 0.3 molar.

A sample tube 50 cm. in length, a magnetic field of approximately 21,000 gauss, and a source of intense white light were used in the investigation. A strained glass (Palmer) compensator was used to detect the relative amount of elliptical polarization.

The present work was undertaken partly to build an apparatus that would employ a photo-electric cell and an electron tube amplifier to measure the elliptical polarization, and partly to repeat the work of Germann and Metz using monochromatic light in place of white light.

An electrical circuit employing a caesium hydride photo-electric cell and an FP-54 vacuum tube has been set up and is ready for operation. It appears that 20 per cent of the rated efficiency of the FP-54 vacuum tube will give sufficient sensitivity to measure the light intensities involved. The Glan-Thompson prisms usually used in such work have been mounted at the centers of large bronze conical bearings extremely carefully made so that a high degree of accuracy in setting can be attained. The angle is indicated by graduations around the circumferences of the ten inch manganese-aluminum alloy discs provided with verniers capable of being read to ten seconds of arc. To provide rigidity these units are mounted on heavy oak bases equipped with leveling screws.

The optical system has been carefully adjusted and the apparatus is now ready to be calibrated. While it is not definitely known that the vacuum tube amplifier circuit will be satisfactory, preliminary experiments have been encouraging.

EDWARD GIRDEN, Brooklyn College

Grant No. 155 (1937). Study of the cerebral mechanisms in hearing.

This investigation was concerned with the analysis of the cerebral basis for the localization of laterally produced sounds. Dogs were conditioned to flex forepaw upon the presentation of a sound-stimulus from its right side, but to inhibit this response whenever the stimulus was sounded from the left side. This discrimination (L-R habit) for both noises and pure tones was then studied under

several conditions in different animals. (1) The L-R habit persisted undisturbed upon (a) complete transection of the corpus callosum, or (b) extirpation of varying amounts of cortex including the temporal lobe of one cerebral hemisphere. (2) This discrimination was also developed in a completely (left) hemi-decorticate animal. (3) The L-R habit was disrupted only if the auditory areas of both cerebral hemispheres were extirpated.

Data recently procured indicate that the cortical area involved in this behavior consists of a restricted portion of the temporal lobe. Its exact limits are now being determined. It is possible that there exists a cortical "projection" system in hearing, comparable to that to be found in vision. Whether particular parts of this area function in the perception of specific tones is now being investigated since the question has considerable bearing upon auditory theory.

The findings of the present study are in agreement with the evidence showing that neural components from both cochleas (ears) are represented upon the cortex of each hemisphere. This growing body of evidence supported by the present data, casts serious doubt upon the early findings from Pavlov's laboratory. The Russian investigators failed to establish the L-R habit after transection of the corpus callosum, from which Pavlov concluded that this ability rests upon the integrative action of both hemispheres. In the light of the present positive data procured by the method of motor conditioned reflexes, one can only conclude that the negative Russian finding resulted from use of their particular procedure; namely, the method of salivary conditioned reflexes.

While training the animals for the present investigation, techniques were developed which made it possible to hasten the conditioning process as well as the subsequent appearance of the L-R habit. A preliminary analysis of these factors has been reported, which indicates that the organism's perceptual organizations have considerable bearing upon the process of conditioning.

The successful termination of this investigation was made possible through grants in 1937 from the Penrose Fund of the American Philosophical Society and the Elizabeth Thompson Science Fund. The further study of related problems, has now been made possible largely through a second grant in 1938 from the Penrose Fund of the American Philosophical Society.

The publications which have resulted from the initial grant of 1937 are as follows:

- GIEDEN, EDWARD, 1938. Conditioning and Problem Solving Behavior. Amer. Jour. Psych. 51: 677-686.
- 1938. Cerebral Mechanisms in Auditory Localization. Proc. Soc. Exper. Biol. and Med. 38: 766-767.
- 1939. Cerebral Determinants of Auditory Localizations. Amer. Jour. Psych. 52: 1-15.

THOMAS HALE HAM, Harvard Medical School

Grant No. 218 (1938). Studies on red blood cell destruction.

The mechanism of red blood cell destruction has been under investigation in chronic hemolytic anemia associated with paroxysmal nocturnal hemoglobinuria (Marchiafava and Micheli disease). As described in a preliminary report¹ and as a result of the present observations, many of the *in vivo* and *in vitro* manifestations of this disease can be explained for the first time. It has been demonstrated that the amount of free hemoglobin in plasma and in urine is increased by agents or by procedures producing an increase in acidity of the blood, such as the administration of acid-forming salts and natural sleep. The hemoglobin in plasma and urine is decreased by producing a decrease in acidity, such as the administration of alkaline salts or hyperventilation during sleep. *In vitro* the red blood cells from these patients suspended in fresh serum show increased hemolysis at an acid pH, slight or moderate hemolysis at the natural pH of serum, and decreased or absent hemolysis at an alkaline pH. It has been demonstrated further that the essential abnormality resides in the red blood cells from these patients; no hemolytic antibody or other abnormality is demonstrable in the serum or plasma. However, a factor present in fresh human serums or plasmas derived from the patients and from normal subjects is required for hemolysis.

The nature of the serum factor has been investigated in collaboration with Dr. John H. Dingle. The serum factor essential for hemolysis appears to be the nonspecific complementary activity present in all fresh human serums and plasmas. This has been demonstrated by the following observations: When complementary

¹ Ham, T. T., 1937. Chronic Hemolytic Anemia with Paroxysmal Nocturnal Hemoglobinuria. A Study of the Mechanism of Hemolysis in Relation to Acid-Base Equilibrium. New England Jour. Med., 217: 915.

activity is decreased or destroyed, the hemolytic activity of the serum of the abnormal red blood cells is decreased or abolished. The addition of guinea pig complement to active human serum usually increases its hemolytic potency. If human complement is partially inactivated or partially removed with consequent loss of hemolytic activity, the addition of guinea pig complement usually restores the hemolytic activity in part. However, if human complement is completely removed or inactivated the addition of guinea pig serum or the serums of certain other animals does not restore the activity. Serum complement was inactivated, inhibited, removed or destroyed by the following methods: absorption with human and sheep red blood cells; absorption with unsensitized and sensitized bacteria; heating at temperatures ranging from 45 to 56° C.; separation of albumin and globulin fractions of serum; treatment with zymin and ammonium hydroxide; addition of salts and acids inhibiting complement; standing at room temperature; filtration through Berkefeld and Zeiss filters. It was apparent from these studies that animal serums could not restore the thermolabile elements of inactivated human serums in this hemolytic system, but could restore the component inactivated by ammonium hydroxide and probably the component removed by zymin.

Since complement is required for the hemolysis of the abnormal red blood cells, an attempt is being made in collaboration with Dr. Dingle to remove and identify a hemolytic antibody from these cells, to determine whether this hemolytic system can be classified as an antigen-antibody-complement type.

In summary, it would appear that the manifestations of this disease depended upon the following mechanism: The abnormal red blood cell is hemolyzed in the presence of human complement; the degree of hemolysis is increased by acid and decreased by alkali.

FRANCIS HARPER, American Committee for International Wild Life Protection

Grant No. 195 (1937). Investigation of extinct and vanishing mammals.

This investigation has been in progress since May, 1936, under the auspices of the American Committee for International Wild Life Protection, and has been supported in part by a grant from the Penrose Fund. It had its origin in a strongly felt need for definite information on the mammals that have become extinct

during the Christian era, on those that are now threatened with the same fate, on the factors contributing to the progressive depletion of the world's mammalian faunas, and on the measures that have been and may be undertaken for their preservation.

The work has involved a survey of a large proportion of the world's more important literature on mammalian faunistics and systematics. The great library of the Academy of Natural Sciences of Philadelphia has furnished the principal material for this survey. In addition, and partly through the collaboration of the International Office for the Protection of Nature in Brussels, a great mass of important and hitherto unpublished information has been assembled by means of questionnaires sent to zoologists and conservation officials in many countries.

The accounts that are being prepared of the various mammals aim to present in concise form the available information on such topics as the following: former and present range and numbers; date and rate of disappearance in each country; causes of depletion; economic importance; and conservation measures. The species and subspecies coming properly within the scope of this report number at least 400 Old World forms, 100 New World forms, and 30 marine forms. The manuscript for a volume on the Old World forms, containing some 300,000 words, is now nearing completion.

During the past 2000 years the world has lost by extinction about 73 forms of mammals. They are distributed by regions as follows: Australia, 9; Malay Archipelago, 3; Asia, 4; Europe, 6; Africa, 9; Madagascar, 1; North America, 24; West Indies, 13; South America, 0; Falkland Islands, 1; Galapagos Islands, 2; oceans, 1. Approximately 75 per cent of these losses have occurred during the past century, and 50 per cent during the past half century. Thus the rate of extinction is being steadily accelerated.

Insular faunas, with their limited ranges, are particularly vulnerable to attack or competition by man and by certain mammal pests introduced by him. Decadence of insular faunas may also be due in some cases, such as that of the West Indies, to the virtually total lack of native predators on mammal; these would doubtless have played a beneficial rôle by eliminating the less fit individuals, and thereby contributing to the survival of the fittest individuals, among the species preyed upon.

The primary factor in the depletion of the world's mammalian

faunas is civilized man, operating either directly through excessive hunting and poisoning, or indirectly through invading or destroying natural habitats, placing firearms in the hands of primitive peoples, or subjecting the primitive faunas of Australia and of various islands to the introduction of aggressive foreign mammals, including fox, mongoose, cat, rat, mouse, and rabbit. Comparatively few species seem to have died out within the past 2000 years from natural causes, such as evolutionary senility, disease, or climatic change.

The chief hope for the survival of the larger mammals of the world lies in the establishment and maintenance of a sufficient number of sanctuaries.

HARPER, FRANCIS, 1938. Factors in the Progressive Depletion of the World's Mammalian Faunas. (Abstract.) *Science* 88: 502.

GERHARD HERZBERG, University of Saskatchewan

Grant No. 139 (1937). Investigation of the solar spectrum in the photographic infra-red; various investigations of molecular spectra.

The mounting for the 20 foot concave grating with which the investigations are to be carried out was considerably delayed because the grating itself was supplied only last June. But the whole spectrograph is now complete apart from some minor details. The spectrograph has been adjusted as far as necessary for the first investigations.

Trial exposures of the solar spectrum in the photographic infra-red have just been made with the cooperation of Dr. R. N. H. Haslam. In addition a complete set of spectrograms of the violet CN bands has been obtained by Mr. R. B. Sutton. These bands are being re-investigated in order to get information about the heat of dissociation of the CN radical, a problem which is closely connected with the problem of the heat of sublimation of carbon. Furthermore new spectrograms of the Swan bands of C_2 are now being taken with the new instrument by Dr. R. N. H. Haslam in order to obtain information about the heat of dissociation of the C_2 molecule.

HERZBERG, GERHARD, 1938. Report of Progress. *Yr. Bk. Amer. Philos. Soc.* for 1937: 232.

KARL F. HERZFELD, Catholic University of America

Grant No. 131 (1937). Theoretical investigations of the absorption spectra of organic compounds.

Grant No. 267 (1938). Investigation of the physical theory of the connection between molecular structure and absorption spectra of organic compounds.

The problem of arriving at an understanding of the absorption spectrum of organic compounds from a theoretical standpoint was approached by first investigating the benzene molecule, the basic compound of the aromatic series. One has to find the possible energy states of the binding electrons and the influence of the molecular structure thereon, as well as the probability of transition between states. Two mathematical methods exist for this purpose. The first (Heitler-London-Slater-Pauling) treats the electrons as forming, in pairs, bonds between pairs of atoms. This method has been applied by Dr. A. L. Sklar (J. Chem. Phys. 5: 669, 1937) before he started working under this grant. The second method (Hund-Mulliken-Hückel) considers every electron as belonging to the molecule as a whole. This method, with certain amplifications, has now yielded results (M. Goeppert-Mayer and A. L. Sklar) which confirm and partly correct the former ones. It was necessary to calculate certain integrals for the evaluation of the interaction energy, which calculations have been performed by R. H. Lyddane and A. L. Sklar.

As the theory for benzene is to form the basis for the investigation of more complicated molecules, the result had to be checked against experiment. The following data were available: absorption measurements in the vapor, liquid and solid states (the latter also at low temperatures) and fluorescence spectra. The task proved more arduous than was expected and the help of other experts had to be sought. A paper by H. Sponer, G. Nordheim, A. L. Sklar, and E. Teller embodies the results. It is believed that the main features of the absorption and fluorescence spectra of benzene in the near ultraviolet are now accounted for, confirming the theoretical interpretation given by Sklar.

The next step is the investigation of the influence of substituting other groups for hydrogen in the benzene molecule. The chemists have found empirically that certain groups affect the absorption spectrum considerably, while others (*e.g.* Cl) leave it substantially

unchanged. The first (*e.g.* NH_2 , OH) are called auxochrome groups because they shift the absorption from the ultraviolet toward the visible and at the same time strengthen it. The problem is to explain why these different groups act so differently. Work in this direction is in progress.

The grant has been used to pay the salary of Dr. A. L. Sklar.

HIRZFELD, KARL F., 1938. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1937: 230.

SKLAR, A. L., 1938 (with GOEFFERT-MAYER, M.). Calculations of the Lower Excited Levels of Benzene. Jour. Chem. Phys. 6: 645-652.

— 1939 (with SPONER, H., NORDHEIM, G., AND TELLER, E.). Jour. Chem. Phys. 7 (April).

— 1939 (with LYDDANE, R. H.). Jour. Chem. Phys. 7 (May).

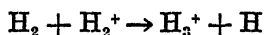
JOSEPH O. HIRSCHFELDER, Princeton University
(now University of Wisconsin)

Grant No. 113 (1936). Calculation of molecular energies and the ionization probabilities of simple molecules.

The absolute rate of chemical reactions can be interpreted in terms of the energy of interaction of the colliding molecules. In this work we calculated the energy of the triatomic hydrogen molecule, H_3 , and the energy of the positive ion, H_3^+ . The triatomic hydrogen molecule is the metastable complex which is formed when a hydrogen atom collides with a hydrogen molecule in either the ortho to para conversions or in the isotopic exchange reactions. The triatomic positive ion is formed in relatively large quantities when hydrogen gas is ionized (at all but the lowest pressures). We are interested in studying these molecular systems because they are the simplest collision complexes which are important from a chemical standpoint, and yet they are the most complicated species for which we can hope at the present time to obtain an adequate quantum mechanical description. Perplexing mathematical difficulties arose in the calculation of these energies which were overcome by the use of the Differential Analyzer of the Moore School of Electrical Engineering of the University of Pennsylvania. We used the Ritz variational method on eigenfunctions formed from 1s-hydrogen-like atomic orbitals and made no further approximations.

Triatomic Hydrogen Molecule. It was found that chemical reactions between a hydrogen atom and a hydrogen molecule take place most easily when the atom approaches the molecule along the line of nuclei. This confirms the results of the Eyring "semi-empirical" scheme. Both methods of computation give the same dependence of the energy on the angle between the nuclei. Our treatment is not sufficiently accurate to obtain a reliable value for the activation energy for the ortho-para hydrogen conversion. Further work on this problem is indicated.

Triatomic Hydrogen Ion. The triatomic hydrogen ion, H_3^+ , is the most stable of the hydrogen ions. We were able to show that the reaction



is certainly exothermic by more than 11 kcal per mole and probably exothermic by around 37 kcal per mole. The most stable configuration for the H_3^+ seems to be intermediate between a right and an equilateral triangle. Two of the normal modes of vibration are infra-red active (in the neighborhood of 1100 wave numbers) and should be observed in the hydrogen discharge spectrum.

Acknowledgments. The first part of this work was conducted at the Frick Chemical Laboratory of Princeton University with the assistance of Professor Henry Eyring and Dr. David Stevenson. The officials of the Moore School of Electrical Engineering gave the fullest cooperation in the use of their Differential Analyzer and Mr. Cornelius N. Weygandt helped me in operating this machine. The rest of the work has been carried out in the Chemistry Department of the University of Wisconsin with the support from the Wisconsin Alumni Research Foundation. Mr. Bertrand Mayland has assisted in making the final computations.

- HIRSCHFELDER, JOSEPH O., 1938. The Energy of the Triatomic Hydrogen Molecule and Ion, V. Jour. Chem. Phys. 6: 795.
— 1937 (with STEVENSON, DAVID). The Structure of H_3^+ , H_3 , and of H_3^- , IV. Jour. Chem. Phys. 5: 933.
— 1938 (with WEYGANDT, CORNELIUS N.). Integrals Required for Computing the Energy of H_3^+ and of H_3 . Jour. Chem. Phys. 6: 806.

WILLIAM HERBERT HOBBS, University of Michigan

Grant No. 189 (1937). Investigation of early discoveries within the American Sector of the Antarctic.

The wide prevalence of confused ideas, and, further, some uncertainties concerning the early discoveries of the Antarctic continent during the first half of the nineteenth century, indicate the need for an historical study of the available documents and of published maps. Such a study would include a thorough search in the many map repositories of America and Europe.

Aided by the grant from this Society and one from the University of Michigan, such a study was made during the years 1937 and 1938, and has now been published in the *TRANSACTIONS* of the Society. The results have proved to be of great importance and must change the views which have generally been held concerning the claims to the discovery of the continent.

Dates of newspaper reports brought to light and of early maps not before known or recognized, have conclusively proved that the American sealing captain, Nathaniel Brown Palmer of Stonington, Connecticut, is entitled to the credit for the discovery of the sixth continent. Further, a before undiscovered map with "Palmer's Land" correctly represented upon it in the position of the salient of the continent lying to the south of Cape Horn, is found to have been published at Hartford only fifty miles from Palmer's home town on September 28, 1821. This date is almost exactly five months after Palmer's return from the Antarctic, and thirteen months before any other map was published on which the Antarctic continent was represented upon the basis of discovery.

In the *Library of the Marine* in Paris and in the *Commerzbibliothek* of Hamburg a map and accompanying explanatory document was unearthed, which with evidence found at Stonington is proven to be Palmer's map of the South Shetland Islands and Palmer's Land. This map includes also the South Orkney islands which were discovered jointly by Palmer and the British sealing captain, George Powell. This great map, printed in three colors and of size 2' x 3', was published in London and is the basis of all later maps which were printed during more than half a century, though it was by British authorities ascribed not to Palmer, but first to Powell, and later to British Royal Navy captains. Of the original map only two perfect copies have been discovered (in France and

in Germany), but with one imperfect copy preserved in England in the map collections of the Admiralty at Cornwall House. Of vital importance as it is, this map is not mentioned in British bibliographies upon the subject of Antarctic exploration, and so far as possible mention of it has been avoided in England, though a French map of full size and with French place names was issued in 1824. More than one attempt was later made by British explorers to copy from it and take credit for its discoveries.

HOBBS, WILLIAM HERBERT, 1939. The Discoveries of Antarctica within the American Sector as Revealed by Maps and Documents. *Trans. Amer. Philos. Soc.* 31, Part I: 1-71.

RUDOLF HÖBER, University of Pennsylvania

Grants No. 179 (1937) and No. 223 (1938). Investigation of the influence of organic substances upon the secretory activity of the liver.

The earlier studies in 1936 and 1937 have been extended mainly in two directions:

(1) It has been shown previously that the secretory activity of the isolated artificially perfused liver of frog can often, although not regularly, be stimulated by one group of organic compounds and definitely inhibited by another, and that these results appear to depend on alterations of the colloidal state of the cellular surface membranes in the direction of either a greater or a smaller dispersion. The secretory activity was measured in these studies chiefly by the capacity of the liver to increase the concentration of some dyestuffs, mainly eriocyanin and bromphenolblue. During the last year, these studies have been extended by trying to find out how far the secretory power of the liver differs with different dyestuffs—in absence of any additional organic substance—and whether these differences can be explained with respect to the chemical structure of the dyes. These studies are still in progress.

(2) In order to gain a better understanding of the colloidal processes of the surface membranes mentioned before, we have continued investigating the influence of a great number of inorganic and organic electrolytes and organic non-electrolytes upon the membrane potentials of muscle and nerve fibres. The results are in good agreement with the concept that there is one group of compounds which, in smaller concentrations, increase the perme-

ability to ions in a reversible way and which, in greater concentrations, produce cytolysis, whereas the other group decreases ion permeability and shows an anticytolytic effect. The report of this series of experiments is going to be printed.

HÖBER, R., 1938 (with MOORE, E.). Experiments Concerning the Secretory Activity of the Liver. *Proc. Amer. Philos. Soc.* 78: 587-593.

DAVENPORT HOOKER, University of Pittsburgh

Grants No. 118 (1936) and No. 173 (1937). Physiological and morphological studies of human prenatal development.

The Origin of the Grasping Movement in Man

1. Observations on the development of the grasping reflex in human fetuses prove the independence of its two phases, finger closure and gripping, as they develop sequentially.

2. Finger closure appears at about 11 weeks of menstrual age as a quick, though only partial flexion of the fingers, in which the thumb is not involved. Though the thumb may become feebly motile as early as 12 weeks, in response to tactile stimulation of the palm, it plays no role in the grasp by 25 weeks, the terminal age of these observations. Finger closure becomes progressively more complete. At and after 16 weeks, tactile stimulation of the palm usually evokes complete closure.

3. Gripping has first been observed at about the 18th week. Though increasing in strength with age, it is still feeble during the age span studied.

4. Further study may alter somewhat the age levels at which these characteristic responses appear. The conditions under which these observations were made, involving slow, progressive asphyxia, necessitate care in generalization.

General Physiological Investigations

During the calendar year, 1938, observations were made on eight human fetuses, ranging from 10 to 25 weeks of menstrual age. Thus, there have been 42 individuals studied during the period of over 6 years during which this investigation has been in progress. The age span covered has extended from 7 to 25 weeks. This constitutes the second largest series ever studied and the only one documented by objective records. Nevertheless, additional cases

are needed to validate our studies in the following stages: (1) between $7\frac{1}{2}$ and $8\frac{1}{2}$ weeks, (2) from 10 to 11 weeks, (3) between 12 and $13\frac{1}{2}$ weeks, and (4) over 16 weeks. Owing to the chance nature of the ages available for study, it may require a considerable time period to fill these gaps adequately.

The observations made this year have been of the greatest importance. The 14 weeks stage is now exceptionally well documented and additional cases in the midperiod of gestation have significantly widened our knowledge.

Preliminary Atlas of Early Fetal Activity

Earlier in the year, it was expected that it would be possible to issue, in preliminary form (photographic prints of action charts, with mimeographed text), an atlas covering fetal activity from its initiation (about 8 weeks, see YEAR BOOK, 1937, Amer. Philos. Soc., pp. 109-110) through the 14 weeks stage. Various emergencies have delayed the preparation of the text, though the photographic prints are done. It is hoped that an edition of 50 copies, for distribution to those working in fetal and infant behavior, may be completed in the next months.

Morphological Program

While the photographic aspects of the physiological studies have progressed excellently, keeping pace with the program so far as that is possible, the morphological side, and particularly the technical, has lagged. Without additional technical assistance this situation will continue. The quality of the technical work has been very high, but its quantity has been low. As emphasis has been placed on the photographic records of the physiological studies, as more urgent and productive of more immediate results, the technical aspects have, of necessity, been sacrificed. However, they have not been entirely omitted. We now have sections cut, stained and mounted from over 25 of the 42 cases studied. Additional series are now being prepared.

Doctor Hogg, who has borne the burnt of a great deal of the technical side, has continued his studies of structure. Doctor Donaldson is progressing with the study of the endocrine organs. Doctor Tryphena Humphrey, who joined our group this autumn, has completed her survey study of available material and will shortly begin her intensive study of the central nervous system.

General Considerations

Excellent, perhaps unsurpassed, facilities are available for these studies. The chief need is now for personnel, technical, secretarial, etc. To secure this, it is necessary to increase the support for the program.

The present high level of attainment is due to the two grants from the Penrose Fund. Because of them, we were able to secure our special laboratories, our equipment and our full-time photographer-technician. These grants have made possible the accomplishment of results that would have required nearly five years to attain without them. My colleagues and I deeply appreciate the generosity of the American Philosophical Society.

HOOVER, DAVENPORT, 1938. The Origin of the Grasping Movement in Man. *Proc. Amer. Philos. Soc.* 79: 597-606.

— 1938. Report of Progress. *Yr. Bk. Amer. Philos. Soc.* for 1937: 221-223

— 1939. Fetal Behavior. *Proc. Assoc. for Res. in Nervous and Mental Disease* (in press).

RUTH B. HOWLAND, Washington Square College,
New York University

Grant No. 186 (1937). The development of bristle bearing tissues in *Drosophila melanogaster*.

Data show that certain bristle mutants, though ordinarily autonomous, may display non-autonomous development if present as mosaics in small patches of tissue. Other mutants are not influenced by surrounding tissues of a different genotype. These facts suggest the possibility that transplantation of bristle forming imaginal tissues might, as in parallel experiments with eye disks, yield interesting information regarding gene action. The assumption finds further support in published data on interaction of genetic and environmental factors in development of bristles. Results of temperature experiments have already led to the postulation of a substance, which, as in the eye-color experiments, tends either to remove or to form bristles.

To test for the presence of such a substance inter-transplantations of dorsal mesothoracic (wing-thorax) disks of a wide series of bristle mutants have been made. These include singed-3, hairless extreme, scute-1, yellow scute-1, spineless and forked. Under the

experimental conditions so far used, no indication of the presence of diffusible substances has been demonstrated, for all implanted disks have developed autonomously, and the host bristles are unmodified. In future experiments it is hoped that (a) by testing the entire range of time relationship between host and donor, (b) by varying the amount of material injected and (c) by implanting disks in closer proximity to the host macrochaeta-bearing regions, positive evidence will be forthcoming.

HOWLAND, RUTH B., 1938. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1937: 203-205.

— 1938 (with GLANCY, E. A.). Biol. Bull. 75: 99-105.

FRANK MONTGOMERY HULL, University of Mississippi

Grant No. 114 (1936). A critical study of the fossil and recent genera of the Syrphid flies with particular reference to their evolution.

This grant made possible an extensive search for (1) the types of described fossil Syrphid flies and (2) the unstudied fossil Syrphid fly material and (3) the studying of rare types of recent genera not available in the United States. Six large museums and one private collection in five European countries were visited. While fossils were obtained from many of these museums, the grant in particular made possible the securing of the rich array of material preserved in amber and belonging to the University of Königsberg in Prussia. In a visit to this collection, about one hundred and fifty specimens of Syrphidae were picked out by sorting through some twelve thousand specimens of insects in amber. These were obligingly loaned by the above institution to the Museum of Comparative Zoology in Cambridge, Massachusetts, where they were studied.

The family Syrphidae today comprises over four thousand recent species and sixty-four fossil species. The number of described fossil Syrphids was more than doubled by this study and many new genera discovered. Among the recent material, twenty-seven new genera and subgenera have been added to the previously known total of two hundred and forty-one genera.

I draw from this study the following concepts concerning the evolutionary changes taking place since the Eocene in this large family: (1) confirmation of the idea that the subfamily Syrphinae is the oldest of the main groups of Syrphidae; (2) that the sub-

families Microdontinae and Eumerinae are related; (3) that the subfamilies Cheilosinae and Xylotinae show close affinity, discovered through the new genus *Eoxylota*; (4) that the subfamily Cerioidinae may be thought of as the most highly specialized group; (5) the application of the concept of phylogeronts for the first time to a number of genera of recent Syrphids; (6) the existence of types in this family that illustrate well what must be closely equivalent to the "allometrons" as proposed by H. F. Osborn; (7) enumeration of perfectly definite types of form and body-shape, or appearance in the family; (8) a summary of the development of mimetic types in a family noted for them.

These studies will be published in two parts. The fossil genera and species will be reviewed in a paper to be submitted to the Museum of Comparative Zoology through the kindness of Dr. F. M. Carpenter. The publication of the revision of the recent genera has not yet been arranged, but the final paper is ready to be submitted for publication. The entire study comprised about six hundred typewritten pages and ninety-nine plates (these plates consisting of photographs and several hundred original drawings).

HULL, FRANK M., 1937. A Critical Study of the Fossil and Recent Genera of the Syrphid Flies with Particular Reference to Their Evolution. Thesis. Widener Library.

LAURENCE IRVING, Swarthmore College

Grant No. 120 (1936). Study of physiological adjustments of respirations in diving mammals.

(Abstracts of papers read at General Meeting, November 19, 1938)

1. When breathing of a mammal is arrested, blood flow decreases through the muscles and increases through the brain. This adjustment of the circulation provides for the respiration of the brain during apnea, and appears significant in the endurance of asphyxia. Carbon dioxide is the most familiar single stimulus for respiratory adjustments, and is known to produce a decrease in muscular and an increase in cerebral blood flow in most mammals. In the muskrat and beaver, however, CO_2 does not decrease muscular blood flow as it does in other mammals, and therefore would be ineffective in activating the vascular adjustment against asphyxia. In addition, CO_2 is not as effective in increasing the breathing of seals, muskrats, and beaver as it is in land mammals. The respiratory

adjustments of diving animals resemble those of land animals, except that the divers execute the adjustments quantitatively more effectively. Diving animals show extreme respiratory adjustments, which are nevertheless mammalian in type, and which may be used to indicate the small adjustments which land mammals make to avoid asphyxia during apnea. The failure of CO_2 as a respiratory stimulus in divers implies that CO_2 is not effective in activating the quick internal responses which mammals in general make to escape asphyxia during apnea.

“The effect of CO_2 in water upon respiration of fish.” By F. E. J. Fry, E. C. Black and Laurence Irving.

2. When the pressure of CO_2 is raised fresh-water fish become more susceptible to lack of oxygen. The catfish is one of the least sensitive to CO_2 , and the bass is one of the more sensitive species. Examination in this way of fifteen species of fish from Opeongo Lake, Ontario, shows that each species may be mathematically distinguished by its sensitivity to CO_2 . Not only are specific distinctions shown by effect of CO_2 , but sex and size differences have appeared as well.

The effect of CO_2 conforms to the expectation from known characteristics of the blood, showing a relation to the internal physiological description of respiration.

The occurrence of different susceptibilities according to species, size and sex coincides with the fact that fish of a given species, sex, and size range together in particular and often restricted environments.

The fish examined represent the typical population of a large lake characteristic of the Canadian pre-Cambrian land surface. This experimental method indicates that we may use known factors of the internal respiratory processes of fish to determine their position and movements in their external environment. The implication is that the known effect of CO_2 upon internal respiratory transport presents the internal sensitivity which activates the fish in selecting a range, and that the combination of CO_2 and O_2 in the environment provides the external stimulus which by affecting the internal sensitivity governs their range and migratory movements.

IRVING, LAURENCE, 1938. Changes in the Blood Flow Through the Brain and Muscles During the Arrest of Breathing. *Amer. Jour. Physiol.* 122: 207-214.

- 1938. Control of Respiration in Diving Animals. *Amer. Jour. Physiol.* 123: 107.
- 1938. Report of Progress. *Yr. Bk. Amer. Philos. Soc. for 1937*: 223.
- The Insensitivity of Diving Animals to CO₂. *Amer. Jour. Physiol.* (in press).

F. B. ISELY, Trinity University, Texas

Grant No. 129 (1937). Study of the ecology of Orthopterous insects.

Further investigations have been undertaken dealing with (I) The correlation between mandibular morphology and food specificity of grasshoppers and (II) Studies on North-Central Texas Tettigoniidae.

I. It was found that among grasshoppers, food specificity and mandibular morphology are definitely correlated. The mandibles of over sixty species (Acrididae and Tettigoniidae) were macroscopically and microscopically studied. These mandibles show four general morphological patterns:

1. The mandibles of the grass feeding Acrididae have broad shallowly furrowed mesial grinding faces.

2. The jaws of the Acrididae eating forbs (broad-leaved plants) have deeply toothed mesial grinding surfaces. The denticles interlock in the grinding process.

3. The flower feeding katydids (Tettigoniidae, Phaneropterinae) have light jaws. The denticular mesial grinding areas are limited in size.

4. The nocturnal, carnivorous Decticids (Tettigoniidae) have heavy cycle like mandibles with the mesial faces reduced to a mere vestige.

II. Seven species of the Tettigoniidae (long-horned grasshoppers), five Phaneropterinae and two Decticidae, were experimentally studied during the summers of 1935-37 (May-July). Among the activities checked under cage conditions were: the food choices; feeding, nocturnal, diurnal, and sex behavior; oviposition technique and stridulation.

Field studies which have been in progress since 1931 were continued during 1937 and 1938. The field records pertain not only to the seven species studied in cages but include in addition the distribution and field activities of 18 other species of Texas Tettigoniidae.

- ISELY, F. B., 1938. Experimental Study of the Survival Value of the Acridian Protective Coloration. *Science* 87: 40-41.
- 1938. Survival Value of Acridian Protective Coloration. *Ecology* 19: 370-389.
- 1938. The Relations of Texas Acrididae to Plants and Soils. *Ecological Monographs* 8: 551-604.
- 1938. Report of Progress. *Yr. Bk. Amer. Philos. Soc. for 1937*: 228-229.

RONALD L. IVES, Science Service

Grant No. 242 (1938). Investigation of areas in Middle Park, Colorado, shortly to be submerged by reservoirs of the Colorado-Big Thompson Transmountain Diversion Project.

Long-range (infra-red) photographs were taken of the Granby Reservoir site, and of parts of the Shadow Mountain Reservoir site from Arapaho Peak (13,506') and from Table Mountain (8,805'). From these photographs, to date, the following findings, largely confirmed by subsequent detailed work, have been made:

1. The presence of a complex system of northwest-trending faults has been confirmed, and the limits of the faulted area extended.

2. A system of faults trending northeastward, cutting the northwest-trending system, of lesser magnitude, and probably of lesser age, was discovered.

3. A considerable extension of the area covered by the Stillwater Glaciation (probably Illinoian) in the Monarch Valley, was discovered, and partially confirmed by later investigations, as yet incomplete. The evidence suggests ice-cap conditions from the Continental Divide down to about 9,000 feet during this time.

Twenty-seven samples of sedimentary rock were collected from accurately-recorded locations in this vicinity, and sent to Dr. Kenneth E. Lohman, of the U. S. Geological Survey, for diatom analysis.

Eight samples of water, from accurately-recorded locations, were sent to Dr. Ruth Patrick, of the Academy of Natural Sciences, Philadelphia, for diatom analysis, at the suggestion of Dr. M. H. Jacobs.

Artifacts found at various locations in the area were investigated. Evidence of rather extensive arrowhead manufacture was found atop Table Mountain, where large chert nodules weather out of the basalt cap. A trail of chips of this chert extends from Table

Mountain, up the Monarch Valley, across the Continental Divide, down Middle Boulder Creek, and south along the mountain front for many miles, suggesting an ancient and much-used trade route.

Numerous observations of weather conditions were made, and sent to Dr. W. J. Humphreys, at the U. S. Weather Bureau in Washington. Observations of advection fogs in the Colorado River Valley, started some years ago, were completed. A paper "Advection Fogs of the Colorado Valley," describing these, will appear shortly in the *Bulletin* of the American Meteorological Society.

Further work in this area contemplated for the immediate future includes:

1. Completion of photography of Shadow Mountain Reservoir site.
2. Detailed study of same area.
3. Further investigation of possible ice cap in Stillwater time.
4. Additional collections of fossil and recent diatoms.

GLENN L. JEPSEN, Princeton University

Grant No. 90 (1936). Faunas and geology of the Fort Union Paleocene in Northwestern Wyoming.

This project, supported by cooperative grants from the American Philosophical Society and the Geological Society of America, is a continuation of research on the classical "Fort Union Problem." It entails a study of the origin, morphology, distribution, and evolution of some of the earliest Tertiary mammals.

The geological correlation of scattered deposits of Paleocene sediments (Puerco and Torrejon in New Mexico, Tiffany in Colorado, Paskapoo in Alberta, Lebo in Montana, and various elements of the "Fort Union" in other states) has long been a problem of considerable faunal and geological significance because the strata involved were deposited between the time of the Cretaceous extinction of the dinosaurs and the time that the modern types of mammals appeared and dominated. Hence the discovery of a sequence of faunas in the Bighorn Basin, containing correlatives of all of the scattered Paleocene faunas in the United States, has led to further study of the animals and sediments of this critical region. This area apparently contains uninterrupted records of mammalian and other life for a longer period than that represented by continuous

deposition in any other known area of Tertiary sediments in the world. Therefore a unique opportunity is presented to learn about the evolutionary sequences of related forms in a limited area through an extensive epoch. For these reasons the mammals are being described in ordinal groups.

Descriptive and stratigraphic work upon the multituberculates has been completed, and serves to emphasize the taxonomic isolation of the group. In many respects, such as the order of replacement of their peculiar teeth, multituberculates show unusual specializations. The order Multituberculata existed longer than any other known group of mammals, and perhaps had an evolution, from reptiles, independent of all other mammals. Economic but not true ancestors of the rodents, the multituberculates from Wyoming are presenting a new conception of their variety and numbers during the Paleocene. These observations make the decline and extinction of the order in the Eocene appear more than ever baffling.

MARTIN KILPATRICK, University of Pennsylvania

Grant No. 248 (1938). Relative acid strengths in non-aqueous solutions.

With the support of a grant from the Penrose Fund of the American Philosophical Society further determinations of acid strengths have been carried out, the photoelectric colorimeter has been improved, and a series of substituted benzoic acids purified for study. With the help of Dr. L. J. Minnick and Dr. W. H. Mears, the interpretation of the results have been considered and presented before the "Symposium on Intermolecular Action" held at Brown University, December 27-29. The paper will be published in the February, 1939, issue of the Journal of Physical Chemistry.

For the reaction



where A_x represents a carboxylic acid, B_x its conjugate base and B_o and A_o represent benzoate ion and benzoic acid respectively, the relation between the relative acid strength, $K_{A_x B_o}$, and the intrinsic acid strength, $K_{a_x b_o}$, (at $D = \infty$) is given by

$$(2) \quad \log K_{A_x B_o} = \log K_{a_x b_o} + L \left(\frac{1}{D} \right)$$

where L is the slope of the line and D the dielectric constant. The free energy of transfer of a proton from the acid x to the standard base is given by

$$(3) \quad -\Delta F = 2.30 RT \log K_{A_x B_0}$$

and on the assumption of Gurney that the energy can be divided into a temperature-independent non-electrostatic part, and an electrostatic part, we obtain for the electrostatic energy V_{ei}

$$(4) \quad V_{ei} = -\frac{2.30 LRT}{D} = \frac{A}{D}$$

where $A \neq f(T)$ and for the entropy change

$$(5) \quad \Delta S_{ei} = -V_{ei} \frac{d \ln D}{dT}$$

A comparison of ΔS_{ei} with ΔS calculated from the relation

$$(6) \quad \Delta S = -\frac{\Delta F - \Delta H}{T}$$

enables us to test the validity of the assumption of Gurney. For the solvent water equation (5) becomes

$$(7) \quad \Delta S_{ei} = -0.005 V_{ei}$$

and a comparison of the entropy values calculated by Hammett using equation 6, and the values calculated from our results by equation 7 indicates that while the ΔS and ΔS_{ei} values correspond in sign and magnitude for the substituted benzoic acids, they differ widely in the case of the aliphatic acids. A more extended study of the substituted benzoic acids will enable us to test this assumption further.

The most important generalization from our results to date is that the relative acid strength of a carboxylic acid is practically the same at the same dielectric constant. This is indicated by our results in ethyl alcohol and dioxane-water mixtures at the same dielectric constant.

RICHARD KRAUTHHEIMER, Vassar College

Grant No. 213 (1938). Corpus Basilicarum Christianarum Romae.

The aim of the Corpus Basilicarum Christianarum Romae, which is published by the Pontifical Institute for Christian Archeology in Rome and which in 1938 was supported by the above mentioned

grant from the Penrose Fund of the American Philosophical Society, is to give a complete survey of the Early Christian basilicas of Rome. The extant structures, whether preserved completely or in remnants or in older descriptions and drawings, are being architecturally and historically surveyed in plans and sections as well as in photographs. They are being described, structurally analyzed, possibly reconstructed in drawings, dated and assigned to their respective places in the development of Early Christian architecture in Rome. The ultimate aim is to determine the position of Early Christian architecture in Rome in relation to its development throughout the Roman Empire and to clarify its connection with Late Roman and Early Medieval architecture.

During the year 1938 work on the second volume of the *Corpus* was carried on. Fascicles one and two of volume one have already been published; fascicles three and four are now in the press. The architectural investigations for this second volume have been almost completed by the present writer and the drawings are in process of execution by his architectural collaborator Mr. W. Frankl in Rome. Among thirty-two churches which were investigated, twenty-five yielded results: they contain either the Early Christian structures completely, although sometimes hidden under later remodellings, or else considerable remnants of the original edifices. Of the twenty-five Early Christian churches which will go into the second volume, ten contain remains which had not been known before; among them are edifices as considerable in size as S. Lorenzo in Lucina, SS. Nereo ed Acchilleo and S. Prisca, which are almost completely preserved and which add a number of new elements to our knowledge of Early Christian architecture in Rome. In those churches which had been recognized before as containing Early Christian structures, the known material could be enlarged and clarified sometimes considerably as e.g. at S. Pietro in Vincoli; at S. Maria Maggiore the foundation walls of the whole church and the original pilaster decoration of the clerestorey could be traced.

The principal conclusions which can be drawn tentatively from the material thus far collected are as follows: (1) Use of Roman houses, sometimes of *Thermae*, for Christian worship during the III century. (2) Creation of the large Roman Early Christian basilica through Constantine and maintenance of this type (330-450). (3) Importation of Near Eastern elements and gradual transformation of Rome into a Near Eastern architectural province

(450-750). (4) Renaissance of Constantinian types in Rome, parallel to the Carolingian Renaissance in the North (750-850).

A tour of investigation through Southern France proved that the development of Early Christian architecture in this province is entirely independent of Rome and linked up directly with the Near East.

KRAUTHHEIMER, R. 1939. The Origins of Early Christian Architecture. *Rev. of Religion*, January: 127-148.

— Preliminary Report on Some Discoveries in Roman Churches. *Amer. Jour. Arch.* (to be published 1939).

GEORGE KREEZER, The Training School at Vineland, N. J.
(now Cornell University)

Grant No. 158 (1937). Determination of the properties of the human electro-encephalogram at different levels of intelligence and for different types of mental deficiency.

Analyses made, since the previous report, of the electro-encephalograms of over 150 subjects have related to the following problems: (1) Consistency in properties of the electro-encephalogram at successive intervals of time for feeble-minded subjects, (2) Relation of the alpha rhythm to level of emotional excitability and (3) Relation of the delta index to intelligence level. The delta index is a measure of the prevalence of waves of long duration (e.g. longer than one-fifth of a second).

The results may be summarized provisionally as follows: (1) The properties of electro-encephalographic records taken at successive intervals of time tend to be highly consistent. The amount of variation differs for different properties of the electro-encephalogram. These results provide a basis for the use of relatively short samples in comparisons of the electro-encephalograms of different individuals and different groups of individuals. (2) The only property of alpha waves found to vary significantly with level of emotional excitability is amplitude. No significant variation occurs in alpha index and alpha frequency. The variation in amplitude was found only in the mongolian type of mental deficiency. These results permit an evaluation of the significance of emotional excitability in the results previously obtained on the relation of alpha waves and intelligence level. It also has bearing on reports in the literature on the relation of alpha waves and emotional labil-

ity among psychotic individuals. (3) There is a tendency for larger delta indexes to be found in mentally deficient subjects of the mongolian type than in those of the hereditary type or in mentally normal subjects. The extent to which this effect may depend on emotional factors requires further investigation. Papers reporting the detailed results of these and previous studies are in preparation.

KREZZER, GEORGE, 1938. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1937: 238-240.

SAMUEL L. LEONARD, Rutgers University

Grant No. 225 (1938). Endocrine studies particularly on hypophyseal-thyroid-gonad relationship.

1. Experimental hyperthyroidism in rats is not conducive to the maximum response of gonadotropic hormones on the ovaries. Experimental hypothyroidism permits an increased ovarian response to injected gonadotropic hormones, of hypophyseal origin, over that of normal rats, but this effect is not true for responses of other gonadotropic principles. Seeking an explanation for this interrelationship, studies on the relation of blood cholesterol to the effect of gonadotropic hormones were made.

Feeding of cholesterol at the level of 200 mg. per day for 12 days to immature female rats did not alter the blood cholesterol of the experimental animals nor did it affect the degree of ovarian response to injected follicle stimulating hormone. Further work along this line was not attempted in view of the following results.

Since high blood cholesterol was reported to accompany hypothyroidism in all species of mammals tested, a study of the blood cholesterol was made in thyroidectomized rats. Our results, surprisingly, indicated that the rat, on a diet of Purina chow, did not show an increased blood cholesterol after the operation. By using litter mate controls in the experiment, whenever a change in blood cholesterol occurred, a similar change occurred in the controls. This was true for periods of hypothyroidism from 6 to 87 days. With increasing age, there was a tendency for lower blood cholesterol in the rats regardless of the presence of the thyroid. It was concluded that blood cholesterol does not seem to be correlated with the response of gonadotropic hormones in the rat.

2. Guinea pigs were thyroidectomized and, together with their controls, were injected with follicle stimulating hormone and pregnancy urine hormone. The ovarian weights of the thyroidectomized guinea pigs injected with the follicle stimulating hormone were 33 per cent heavier than those of the controls, while the ovarian weights of the animals injected with pregnancy urine hormone were the same. This is in agreement with the results found in rats.

However, young cockerels subjected to the same operation and injected with hypophyseal gonadotropic hormone showed a 45 per cent decreased response in testes weight from that of the controls. The importance of the thyroid function in relation to the reproductive organ depends greatly on the species studied.

LEONARD, S. L. Thyroidectomy and Gonad Response to Gonadotrophic Hormones. *Anat. Rec.* 72—Suppl.: 119.

— 1938 (with ROLLER, K.). The Blood Cholesterol in Thyroidectomized Rats as Related to the Effectiveness of Gonadotropic Hormones. *Endocrinology* (accepted for publication).

T. M. N. LEWIS, University of Tennessee

Grant No. 156 (1937). Excavation of archaeological sites in the Chickamauga Dam Basin, Hamilton County, Tennessee.

The destruction of large prehistoric village sites and spectacular earthworks by the inundating waters of the Tennessee Valley Authority dams has prompted extensive archaeological investigation in the Tennessee area during the past five years. An average force of 175 persons supervised by trained archaeologists has been constantly employed in the dam reservoirs. A large quantity of documented archaeological materials and skeletal remains has been recovered and this is now undergoing analysis in the University of Tennessee laboratories. The majority of the reports covering the Tennessee investigations are to appear in the form of Annual Bulletins of the Bureau of American Ethnology.

At this writing it is only possible to present a limited number of important revelations which have been brought to light, for in "dirt archaeology" the mill does not begin to grind out its verbal record until the culture-indicative materials have been analyzed and classified, and these results correlated with the field notes made by the investigators.

The large earthworks having the form of truncated pyramids

have been objects of much curiosity. Practically nothing was known about their significance until recent years. Several of these have been meticulously excavated by us and the resulting finds seem to link the aboriginal peoples of Tennessee culturally with those of Middle America. Investigators working in the latter area have found that the stone pyramids which bore the temple buildings are made up of superimposed sub-structures and the remains of fallen buildings which once occupied their summits. This same procedure was carried out by the Tennessee aborigines in a somewhat cruder manner. The sub-structures are not the typical stone-plated affairs of the Middle American area. They were constructed of clay and the superstructures in which the religious and governmental ceremonies were enacted, were constructed of poles, bark, cane and clay daub, instead of stone. The majority of these buildings were destroyed by fire, and occasionally large portions of the carbonized remains are found upon the indurated clay floors of these buildings, having been smothered by clay daub or wattle from the roof. Elevated square or circular fireplaces constructed from puddled clay are always present in the center of the floors. Occasionally also have been found elevated rectangular platforms and seats of hard, burned clay. Abrupt changes in architectural details of these superimposed structures suggest changes in cultural occupations, a postulation which the result of laboratory analysis of materials associated with these levels will either confirm or deny. Either stairways or ramps lead to the summit of these structures.

While this type of earthwork was intended primarily as an elevated location for the town's chief ceremonial house, interments of important individuals are in some instances found in pits beneath the floor levels. Nearly always these are lavishly accompanied by mortuary offerings in the form of pearl and shell beads, copper ornaments, engraved shell gorgets and other implements and utensils of bone, stone, shell and pottery.

The results of dendrochronological studies will probably provide us with dates for some of the prehistoric sites within the near future. Hundreds of partially charred beams from houses have been recovered and treated with preservative. The annual growth rings present in these specimens are being measured and charted by students of dendrochronology at the Universities of Chicago and New Mexico. The computation of these dates will elucidate many of the problems relating to cultural contemporaneity and succession.

So extensive have some of the excavations been that the exact location of every house, burial, stockade and other manifestation has been recorded on plats. The villages were small and only in rare instances could the number of inhabitants have exceeded 1,500 or 2,000. The small, rude huts were placed in close proximity to each other. The dead were buried haphazardly throughout the village and frequently new graves were let down into old ones because of the absence of markers. Seldom was a grave pit dug to a depth of more than two feet. We are referring here to the mode of burial practiced by the prehistoric inhabitants of the Chickamauga Dam Basin near Chattanooga, and not to areas in the central and western part of the state where it was customary for the aboriginal peoples to bury their dead in cemeteries.

Three additional dams are to inundate many more important archaeological sites, and present plans are to continue investigations until an ample record of the prehistoric inhabitants of these reservoir areas has been uncovered.

CARL C. LINDEGREN, University of Southern California

Grants No. 169 (1937) and No. 247 (1938). To analyze four-strand crossing over in *Neurospora crassa*, especially because no other available organism is so well adapted to such analysis; and to study the chromosomes cytologically.

The first step in such analysis is to collect and purify mutant stocks. These mutants all occurred spontaneously and the stocks were further selected to improve their fertility. A cytological study of the chromosomes showed that it is possible to count the gross (uncoiled not ultimate) chromomeres and correlate the two largest linkage groups with the two largest chromosomes.

The linkage of 4 loci in the second chromosome was established by a series of crosses and it was further shown that crossing over between the four strands was not at random, but followed a pattern already found in the first chromosome, thus confirming the non-random nature of four-strand crossing over. The superiority of *Neurospora crassa* over other biological forms for analysis of crossing-over, the failure of workers on *Drosophila* to agree among themselves in their analysis of this problem in addition to the fact that they must of necessity work with abnormal chromosomes, makes this corroboration in the second chromosome of *Neurospora* of results

already obtained in the first chromosome very important and a study which it will be interesting to carry further.

- LINDEGREN, CARL C., 1938 (with RUMANN, SIEGFRIED). The Chromosomes of *Neurospora crassa*. Jour. Genetics 36: 395-404.
- 1939 (with LINDEGREN, GERTRUDE). Non-random Crossing Over in the Second Chromosome of *Neurospora crassa*. Genetics 24: 1-7.
- 1939 (with BEANFIELD, VIRGINIA, and FOURATT, ROBERTA). Inbreeding to Increase Fertility in *Neurospora*. (Accepted for publication in March Issue of Bot. Gazette.)

KENNETH N. MCKEE, New York University

Grant No. 231 (1938). Study of the French theater during the Revolutionary period.

The purpose of my project was to study the theater of the French Revolution, not from the literary point of view, but as it was accepted and interpreted by the public of the 1790's. My previous work in the field indicated that literary histories covering the Revolutionary theater were inadequate and that a re-evaluation of the dramatic counterpart of the French Revolution was most needful and desirable.

My research during the summer was conducted in the libraries of Paris (Bibliothèque Nationale, Bibliothèque de l'Arsenal, Bibliothèque Thiers, and Bibliothèque de la Ville de Paris) and in London (British Museum). I was interested chiefly in finding reviews of plays in Revolutionary newspapers in order to correlate public opinion with the success or failure of dramatic productions. I was able to locate more than sixty papers which carried dramatic criticism, but I found that the files of certain papers in the Bibliothèque Nationale were very incomplete and that the vast Crocker collection in the British Museum has never been entirely catalogued. In spite of breaks in continuity, they have yielded an enormous amount of source material which has never been touched in treating the theater. These reviews tend to create a somewhat different impression of Revolutionary drama from that which has generally been held by literary critics.

This material is being microfilmed, and, in due time, it is my intention to use it as a basis for a history of the Revolutionary theater.

- McKee, KENNETH. Suggestions for a re-appraisal of the theater of the French Revolution (given before the Modern Language Association, December 28, 1938).
- The Evolution of the Rôle of the Priest on the Parisian Stage During the French Revolution (to be published in 1939).
- The Provincial Theater during the French Revolution (in preparation).

S. O. MAST, Johns Hopkins University

Grant No. 187 (1938). Regulation of the water content of *Amoeba mira*,¹ and adjustment to changes in concentration of salts in the surrounding medium.²

In a preceding investigation D. L. Hopkins ('38) demonstrated that the cytoplasm of *Amoeba mira* consists almost entirely of hyaline vacuoles which vary greatly in size, and granule-like bodies, imbedded in a hyaline ground substance, which are barely visible under a magnification of 1800 diameters, and that in active specimens the small hyaline vacuoles coalesce with other small hyaline vacuoles or with food which has recently been ingested, forming large hyaline and large food vacuoles both of which are eliminated from time to time. He also demonstrated that under certain unfavorable conditions granules form in the hyaline vacuoles and that these granules have staining properties which are like those of granules usually called mitochondria.

In the present investigation the work of Hopkins was extended and the following was demonstrated:

The ability of adjustment in *Amoeba mira* to change in the concentration of salts in the surrounding medium is very extraordinary. For example if specimens of this species are transferred directly from normal sea-water to sea-water diluted with distilled water to 5 per cent, they become inactive and swell rapidly until they have become several times their original size; then they begin to shrink and continue until in about 3 hours they are again normal in size. If they are then transferred to normal sea-water they shrink so rapidly that they become greatly wrinkled and much smaller than normal; then they begin to swell and continue for about 3 hours until they have again become normal in size, after which they soon begin to feed and behave normally in all respects.

¹ A small marine rhizopod often called *Flabellula mira* Schaeffer.

² The experiments and observations concerned in this report were made by D. L. Hopkins.

Moreover, if the concentration of the sea-water is gradually increased by evaporation, they eventually become fully adjusted to a solution which is about 10 times more concentrated than normal sea-water.

The results obtained in quantitative measurements demonstrate that adjustment to low salt concentration in the surrounding medium is brought about in part by rapid increase in the rate of growth of the vacuoles and the frequency of their elimination, but mainly by the loss of salts, owing to diffusion, until the osmotic concentration in the cytoplasm is nearly as low as that of the surrounding medium, and that adjustment to high salt concentration is brought about by cessation in elimination of fluid by means of vacuoles and entrance of salts until the concentration in the cytoplasm nearly equals that of the surrounding medium.

In amoebae which are fully adjusted and actively feeding there are no mitochondria-like granules in the vacuoles. In such amoebae the rate of elimination of water through the vacuoles is directly proportional to the volume of the amoebae and inversely proportional to the salt concentration of the surrounding solution.

Under adverse conditions the amoebae cease feeding, then mitochondria-like granules begin to form in the hyaline vacuoles and as the number of these granules increases the rate of elimination of fluid decreases. This often continues until the elimination of fluid ceases entirely, regardless of the osmotic concentration of the surrounding medium.

In encysted amoebae practically all the vacuoles contain mitochondria-like granules and no fluid is eliminated. During excystment these granules dissolve, and as they dissolve the vacuoles swell, fluid is eliminated, and the amoebae begin to move and feed.

This clearly demonstrates that the granules in the vacuoles are correlated with the elimination of fluid.

The fact that the rate of growth of the vacuoles and the rate of elimination of fluid varies inversely with the number of granules formed, indicates that the granules are formed by precipitation of substance in the solution in the vacuoles and that this substance is osmotically active when it is in solution but osmotically inactive after it has precipitated, i.e. after the granules have been formed. And the fact that the rate of growth of the vacuoles and the rate of elimination of fluid varies directly with the volume of the cytoplasm, indicates that this substance is formed by the cytoplasm

and poured into the forming vacuoles at a rate which varies directly with the volume of the cytoplasm.

The mitochondria-like granules stain with Janus green B, are soluble in ether, alcohol, chloroform and dioxan but not in water, glycerine or acetone. They are destroyed by acids, formaldehyde and other reducing agents but not by alkalies, hydrogen peroxide, osmic acid, and other oxidizing agents. They dissolve in the process of making permanent mounts by all ordinary methods but not if the amoebae are fixed in osmium tetroxide vapors and cleared in glycerine or acetone and mounted in glycerine or cellophane.

It is therefore obvious that the substance in the granules in question has properties similar to those of granules ordinarily designated mitochondria and that this substance is formed by the cytoplasm, is eliminated through the vacuoles and probably functions at least to some extent in the regulation of the water content of the cell.

HOPKINS, D. L., 1938. The Vacuoles and Vacuolar Activity in the Marine Amoeba, *Flabellula mira* Schaeffer and the Nature of the Neutral Red System in Protozoa. *Biodynamica*, No. 34, 1-22.

C. E. MENDENHALL † AND G. BREIT, University of Wisconsin

Grant No. 31 (1934). Experiments on nuclear disintegration and scattering with protons and deuterons accelerated by about 300 k.v.

BREIT, G., 1938. Report of Progress. *Yr. Bk. Amer. Philos. Soc. for 1937*: 154-155.

HAWORTH, L. J., 1938 (with KING, L. D. P.). The Excitation Function for the Disintegration of Li^7 Under Bombardment by Low Energy Protons. *Phys. Rev.* 54: 38-47.

— 1938. The Stopping Power of Lithium for Low Energy Protons. *Phys. Rev.* 54: 48-50.

E. D. MERRILL, Harvard University

Grant No. 176 (1937). A study of the Bornean species of the Myrtaceous genus *Eugenia* (*Syzygium*).

(Abstract of paper read at General Meeting November 19, 1938)

In modern times most botanists have considered *Eugenia* Linnaeus as a collective group, although various attempts have been

† Deceased August 18, 1935.

made from time to time to establish generic segregates; approximately 2,500 binominals have been published. A compilation of data appertaining to endemism for various regions in the Old World tropics shows the following: British India (85 species, 53 per cent endemic); Siam (90 species, 26 per cent endemic); Indo-China (68 species, 47 per cent endemic); China (49 species, 55 per cent endemic); Malay Peninsula (141 species, 60 per cent endemic); Java (70 species, 45 per cent, endemic); Philippines (182 species, 81 per cent endemic); and New Guinea (117 species, 85 per cent endemic). Within the *Eugenia* complex no less than 36 generic segregates have been proposed by this or that author since the genus was established in 1753. With the exception of *Syzygium* Gaertner and *Jambosa* de Candolle, these proposed segregates have not been recognized or adopted by other than the individuals who proposed them. Approaching our problem with a consideration of *Eugenia* Linn. *sensu latiore*, we find that it is possible and practicable to reduce the *Eugenia* complex by the recognition of two small generic segregates for certain Old World species, that *Syzygium* and *Jambosa* can not be distinguished by any single character or combination of characters; that *Eugenia* may properly be restricted to the American species, with a relatively few in the Old World tropics; and for the bulk of the Old World species *Syzygium* is the proper generic name, as this group can be distinguished from the New World *Eugenia* by definite flower, seed and inflorescence characters. The Bornean species now approximate 160 species, of which 45 representatives of *Syzygium* are described as new.

- MERRILL, E. D., 1937 (with PERRY, M. L.). Reinstatement and Revision of *Cleistocalyx* Blume (including *Acicalyptus* A. Gray) of the Myrtaceae. Jour. Arnold Arb. 18: 322-343, pls. 215.
- 1938 A Synopsis of *Acmena*, a Valid Genus of the Myrtaceae. Jour. Arnold Arb. 18: 1-20.
- 1938. The Myrtaceae of China. Jour. Arnold Arb. 19: 191-247.
- 1938. The Indo-Chinese Species of *Syzygium* Gaertner. Jour. Arnold Arb. 19: 99-116.
- The Myrtaceous Genus *Syzygium* Gaertner in Borneo. Mem. Am. Acad. Arts Sci. (in press).

ALLAN C. G. MITCHELL, New York University
(now Indiana University)

Grant No. 191 (1937). A study of the gamma rays from artificially radioactive sources—Measurement of their energy and determination of the emitter of the gamma ray.

The neutron source consisting of 211 milligrams of radium salt, obtained originally for work on the scattering of neutrons, has been used during the past year to investigate the origin of gamma rays from artificially radioactive substances. In addition several new radioactive isotopes of long life have been discovered and investigated.

When indium is irradiated by slow neutrons two radioactive periods are usually observed. These have half-lives of 13 seconds and 54 minutes, respectively. These two periods come from the same radioactive nucleus (In^{116}) and are said to be isomeric. They have been studied with the purpose of determining the nuclear energy level scheme of In^{116} . In a previous communication a gamma ray of energy 1.4 million electron volts was measured. This gamma ray was shown to be associated with the 54 minute activity. No gamma ray of 13 second period could be found. From the known beta ray and points—3.1 Mev for the 13 second period; 1.4 Mev for the 54 minute period—and the energy of the gamma ray, an energy level diagram has been constructed which accounts for all the experimental facts. The two excited levels of In^{116} from which disintegration takes place are separated by 0.3 Mev, the level corresponding to the 13 second period lying higher. Gamma ray transitions between these two levels can be forbidden by choosing quantum numbers which differ by 5 units.

Several elements, among them indium and silver, were irradiated with slow neutrons for a period of several months. The radium beryllium mixture, provided by the grant, is an excellent source of neutrons for long period irradiations since its activity does not decrease appreciably with time. Of all the elements irradiated, about fifteen in number, only indium and silver showed long periods of any intensity.

Aside from the well known periods of 13 seconds and 54 minutes, a long period of 45 ± 3 days was produced quite strongly in indium. The ratio of the activity of the long period to that of the 54 minute activity is approximately in the ratio of the relative

abundance of the isotopes In^{113} to In^{115} . It is shown that the long period is produced when In^{113} captures a neutron to form In^{114} . The capture cross sections for the processes are given by the relation $\sigma_{113} = 0.56 \sigma_{115}$. This activity had no detectable gamma ray emission connected with it.

A long period of very weak activity was also discovered in silver. The period is greater than 3 months.

- MITCHELL, ALLAN, C. G., 1938. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1937: 219-221.
- 1938. Long Period Activity of Indium Produced by Slow Neutrons. Phys. Rev. 53: 269.
- 1938 (with LANGER, L. M.). The Nuclear Isomers of In^{116} . Phys. Rev. 53: 505.

S. A. MITCHELL, Leander McCormick Observatory, University of Virginia

Grant No. 64 (1935). Study of photographs of the "flash spectrum" taken at the total eclipse of the sun on October 21, 1930, on "Tin-Can Island."

A study has been in progress of the spectra of the chromosphere and the corona obtained at the total solar eclipse of October 21, 1930 on Niuafoou Island of the Tonga group in the mid-Pacific Ocean. Dr. G. F. W. Mulders of Utrecht (Holland) spent approximately six months at Harvard Observatory and a year and a half at Mt. Wilson Observatory engaged in the work. His time was devoted, (a) to the measurement with microphotometers, first at Harvard and later at Mt. Wilson, of the photographs of spectra, and (b) to the reduction and discussion of the measures.

In addition to work done at home at the Leander McCormick Observatory, Mr. Mitchell spent two months in 1936 at Mt. Wilson Observatory. At the present time (December, 1938) satisfactory progress is being made with the assistance of Dr. Emma T. R. Williams of the McCormick Observatory staff. Some of the results were incorporated in the Penrose Memorial Lecture entitled, "With an Astronomer on an Eclipse Expedition."

- MITCHELL, S. A., 1938. With an Astronomer on An Eclipse Expedition. Proc. Amer. Philos. Soc. 79: 341-360.
- 1938. With an Astronomer on an Eclipse Expedition. Sci. Monthly 47: 5.
- 1938. Energy Distribution in the Continuous Spectrum of the Corona. Publ. Astr. Soc. Pacific 50: 225.

MORAVIAN SEMINARY AND COLLEGE FOR WOMEN

Grant No. 168 (1937). Research in Moravian music manuscripts, located at Bethlehem, Pa., leading to a complete and authoritative catalogue of the material and an historical monograph summarizing the findings of the study.

(Abstract of paper read at General Meeting, November 19, 1938)

An appropriation from the Penrose Fund of the American Philosophical Society was made to the Moravian Seminary and College for Women, of Bethlehem, Pennsylvania, for the purpose of making a critical catalogue of original compositions by American Moravians during the one hundred years from 1742 to 1842. Out of a mass of two thousand or more manuscripts found in various Moravian churches in Pennsylvania, Maryland, and North Carolina, we secured some four hundred that were original compositions made in this country by sundry Moravian musicians for the enrichment of the liturgical seasons of the church.

Most of these are anthems for four or eight voices, with orchestral accompaniment of strings, with the addition also of wood wind and brass in some cases. Of the ten men whose works we examined, five were born on this continent. The obvious musical continuity in the series indicates a transfer of musical technique from the older to the younger workers in very evident fashion. Only a few of the works are secular, but these are extremely interesting. Among them is a series of Parthien or suites for wind instruments, obviously used for serenading purposes, and a group of six quintets for two violins, two violas, and violoncello, which have been definitely determined to be the oldest compositions in sonata form composed in America.

RAU, ALBERT G., 1938 (with DAVID, HANS T.). A Catalogue of Music by American Moravians, 1742-1842. Moravian Seminary and College for Women.

J. J. NASSAU and S. W. McCUSKEY, Case School of Applied Science

Grant No. 229 (1938). The development and construction of a photo-electric device for counting star images on a photographic plate.

The tedious work of counting the number of stars of various magnitudes on a photographic plate in order to provide data for studies of galactic structure has long been a hindrance to rapid and

comprehensive advance in this field of astronomy. To reduce this factor as far as possible a machine has been developed which will count the star images and sort them into magnitude classes by photoelectric scanning of the photographic plate.

An amplifier and counter system using a gas filled photocell and Thyratron grid discharge tubes has been developed and built during the past few months. From preliminary tests it appears that the accuracy of sorting will equal or surpass that of the visual counting method now employed. Four Thyratron counting tubes in conjunction with telephone counters are used to cover any range in stellar magnitude desired. The device in effect is a photoelectric photometer which measures the stellar image density, not by means of a galvanometer deflection but by a series of relays adjustable to any predetermined current.

The mechanical framework, which provides electrically slow and fast motions of the photographic plate in two perpendicular directions, is under construction at the present time. A beam of light formed by a small adjustable aperture and 6 volt lamp is focused upon the plate in the middle of a dimly illuminated field which the operator can view through a binocular microscope. After passing through the plate the light is collected by a lens and focused on the element of the photocell. Interruptions of this beam by star images of varying densities and sizes are recorded by the counters.

To date nothing concerning the counter has been published.

The electrical device of the apparatus is now complete. It is expected that the optical and mechanical parts will be finished early in 1939, when a report of the performance of the machine will be given.

CURTIS L. NEWCOMBE, University of Maryland

Grant No. 199 (1937). A physical, chemical and biological investigation of the layer of low oxygen content in the deeper waters of the Chesapeake Bay in the Solomons Island Region.¹

The results of the hydrographical studies of the low oxygen waters of the Chesapeake Bay conducted at the Chesapeake Biological Laboratory with the aid of a grant, show substantial progress during 1938. The investigation has been centered, largely, upon gaining a fuller understanding of the oxygen-poor waters that

¹ This study is being conducted by Curtis L. Newcombe, assisted by Andrew G. Lang.

are found in the lower strata during the warmer seasons. Water samples for analysis have been collected over the entire length of the Bay and the Patuxent River, and at regular intervals from a series of ten stations located between Cove Point and Point Lookout. Regular samples were taken at the surface, bottom, and intervening depths in both shallow and deep water areas. On a basis of approximately 7,000 widely collected records made available by this work, it is now possible to construct a reasonably comprehensive picture of seasonal, daily, hourly, and bathymetric changes that occur in the Bay and certain estuarine waters.

The oxygen content of the bottom waters was greatly reduced through the months of April and May and became critically low during the latter part of June. Zero concentrations of oxygen first developed in the very deepest waters. Oxygen depletion progressively extended into shallower water as the season advanced, and developed more generally over the deeper waters of the Bay, impoverishment reaching a climax late in August. At this time and during a part of September as well, the waters of the Bay in the Solomons Island Region and northward were almost devoid of oxygen, except for a surface layer about nine meters in thickness. Even this surface layer contained reduced amounts of oxygen at this season.

After September, the oxygen content of the Bay waters steadily increased, and evidence of oxygen stratification was not observed during this period.

The development of oxygen-poor strata is accompanied normally by correspondingly significant changes in salinity. Although surface water has not varied greatly in salinity through the seasons, subsurface water became increasingly saline until late August. Where atypical oxygen values have been observed, similarly atypical salinity values are noted. However, the existence of a definite cause and effect relationship between salinity and oxygen depletion as yet has not been established.

The condition of oxygen and salinity stratification in the Bay is frequently subject to partial or complete destruction in a very short period of time and over wide areas of the Bay. During the spring when stratification is less marked, recovery from such destructive mixing of the waters is rather slow and may require several weeks to attain a normal intensity. During the late summer when stratification is particularly severe, complete destruction of strata may

occur almost overnight and reconstruction of strata may be complete within several days. The breakdown of stratification when it occurs is ordinarily most thorough, extending uniformly from the surface to the greatest depths of the Bay. The agencies responsible for a large-scale mixing of this kind are unknown. It is apparently not the work of any single force, but rather the outcome of a combination of conditions as yet unknown. Data on certain particular conditions including turbidity, nutrient salt and carbon dioxide contents, and pH have been obtained and are proving suggestive of the lines of attack to be employed in the experiments that are to follow.

Hydrographically considered, the low oxygen condition is the most important individual feature of the Chesapeake Bay. Its biological importance is unknown. It is hoped that the continuation of this study will provide an understanding of the mechanism creating this anomalous condition and in turn, afford a knowledge of its biological import.

NEWCOMBE, CURTIS L. (with HORNE, WILLIAM A.), 1938. Oxygen-poor Waters of the Chesapeake Bay. *Science* 88: 80-81.

JENS RUD NIELSEN, University of Oklahoma

Grant No. 197 (1937). Study of the Raman spectra of simple compounds in different states of aggregation.

Although the great majority of investigations of the Raman effect have been made with the scattering substance in the liquid state, a study of the Raman spectrum of the vapor is required to give accurate information about molecular vibrations. On the other hand, the Raman spectrum of a substance in the crystalline state may yield information about intermolecular forces which is necessary for the complete interpretation of the Raman spectrum of the corresponding liquid.

A set-up has been constructed for studying the Raman spectra, in both gaseous and liquid states, of substances transparent to light of wave-length 2537 Å. The investigation of a series of aliphatic alcohols is under way.

The various methods proposed for investigating the Raman spectra of crystal powders have been carefully tested and, in part, improved. The Raman spectra of crystalline boric acid, anhydrous and hydrated sodium metaborate, borax, and anhydrous calcium

metaborate, and of their aqueous solutions, as well as of the aqueous solution of sodium aluminate, have been studied. Several halides of mercury, cadmium and zinc have been studied in the crystalline state. For each substance, previously investigated, new lines were found. An attempt is being made to correlate the results with the available crystal structure data.

W. B. REDMOND, Emory University

Grant No. 190 (1938). Immunological studies on bird malaria.

With the aid of this grant I have been able to continue research on the immunology of malaria in birds. After numerous unsuccessful attempts it has been found possible to immunize birds against malaria without producing active infections. This was done by 'treating' parasitized red blood cells from a highly infected bird so as to kill the parasites but not to destroy the blood cells. Seven to 10 daily injections of this 'vaccine' into birds previously determined to be uninfected immunized these birds to an inoculation of living parasites. Before giving the test inoculation each bird was tested for parasites by subinoculation into normal birds. It was found that those birds injected with blood treated for the greatest length of time were parasite free, while those injected with blood treated for a shorter length of time had developed latent infections. None of the experimental birds showed infections either during the injections or following the injection of the test parasites. The initial experiments have just been concluded and enough results are not available at the present time for publication.

Several other experiments have been attempted, most of them with little or no success. One other, however, is almost ready for publication. It involves the cross immunity of a new strain of avian malaria recently reported.

The results of the study of the cross immunity of a similar strain (to be published in the *Journal of Infectious Diseases*) indicate that the degree of cross immunity may not always be comparable in every strain of a species. Two strains each in two distinct species have been carefully compared and give proof that the degree of cross immunity depends more on the virulence of the strain than on the relationship based on morphological character-

istics. This new strain is a strain of one of these previously studied strains and has been found to conform with the above cross immune relationship. Numerous cross infections with the three other strains, one of the same species and two of a different species, have been made. The most effective immunity was not produced by the strain of the same species, but by the strains that produced the highest initial infections. This relationship probably does not hold for all strains and species of bird malaria. Further work with other strains will be carried on in the future as time and funds are available.

HORACE G. RICHARDS, New Jersey State Museum

Grant No. 154 (1937). For the collection and study of the land mollusks of the Island of Roatan, Honduras, with special attention to the bearing of this fauna to problems of paleogeography.

Grant No. 252 (1938). For the collection and study of land mollusks from Corn Island, Nicaragua.

Mollusks were collected from Roatan, the largest of the Bay Islands, located about 40 miles off the north coast of the Republic of Honduras. Sixteen species of land shells were recorded of which four were described as new. The best collecting was among the Pleistocene limestone near the western end of the island. In addition, mollusks previously collected from other of the Bay Islands have been studied. The relationship is definitely Central American. Those species that do show a more or less distant relationship to the West Indies might have reached the Islands and the Central American mainland by a Tertiary land bridge connecting Jamaica and Haiti with Nicaragua and Honduras.

Great Corn Island lies in the Caribbean Sea about 40 miles east of Bluefields, Nicaragua. The island is about $2\frac{1}{2}$ miles long by two miles wide and rises at its highest point to 370 feet above the sea. It is entirely composed of igneous rock of late Tertiary or early Pleistocene age. There is no Pleistocene limestone such as is found on certain other islands off the Central American coast. The molluscan fauna is exceedingly poor, consisting almost entirely of "drift" species common throughout all of Tropical America and of species described from the mainland of Central America. One new species was discovered and described. The absence of West Indian species is noteworthy. There are several possible explana-

tions for this poor fauna. In the first place the absence of limestone is frequently correlated with a poor fauna, particularly in this part of the world. Furthermore, much of the island is under cultivation and this may have caused the depletion of the original fauna.

RICHARDS, HORACE G., 1938. Land Mollusks from the Island of Roatan, Honduras. *Proc. Amer. Philos. Soc.* 79: 167-178.

—— Land Mollusks from Corn Island, Nicaragua. *Proc. Amer. Philos. Soc.* 81: (in press).

F. K. RICHTMYER, Cornell University

Grant No. 184 (1937). Intensities of x-ray satellites.

Work on this problem has been under way for several years and is part of a larger program devoted to studying the conditions for and method of producing doubly ionized atoms (neutral atoms minus two extra-nuclear electrons), and the energy transitions in such atoms which give rise to line radiation. The study of x-ray satellites is one approach to this problem of double ionization.

X-ray satellites are in general rather faint lines. To get measurements of their intensities relative to the lines arising from single ionization, for use in checking theory and in predicting new theories, it is necessary to obtain data with the highest possible accuracy. It has therefore been necessary to regard work previous to 1937 as tentative.

Accordingly, a part of the work during the current year, under the grant from the American Philosophical Society, has been devoted to developing important methods of measurement and to the elimination of the various spurious effects which are inherent in work involving taking of any high-precision data with rather elaborate apparatus.

Specifically, we have devoted some time to obtaining suitable targets of the elements in the atomic number range 73-92; and to means of subjecting these targets to suitable power inputs to produce radiation of acceptable intensity for measurement.

It has also been necessary to improve the ionization chamber attached to the two-crystal x-ray spectrometer so as to eliminate instability due to sources of radio frequency and spurious electrical impulse fields inherent in work in any physical laboratory involving a large variety of types of research. These improvements have

been extended to the amplifying system connected with the ionization chamber. We have been successful in eliminating these spurious effects and the main part of our present instability comes only from the apparently unavoidable disturbances due to cosmic rays.

We are now satisfied that our experimental data are as accurate as can be reasonably obtainable. It is our aim to report experimental results of such a precision that whatever future developments there may be, it will be unnecessary to repeat these data. We have nearly finished checking data on the $L\alpha$ satellites and the $L\beta_1$ satellites in the obtainable elements in the atomic number range 73-92. A paper on the excitation potential of the $L\alpha$ satellites for Au-79 is being presented at the Washington meeting of the American Physical Society, December 29, 1938. It is hoped to have a full report of the work ready for presentation to the spring meeting of the American Philosophical Society.

WILLIAM J. ROBBINS, New York Botanical Garden

Grant No. 232 (1938). Study of the conditions necessary for the unlimited growth of excised tissues of higher plants, primarily excised root tips.

This project, supported in part by a grant from the American Philosophical Society, is concerned with a study of growth substances for plants. A preliminary investigation of biotin has been made, which has resulted in the development of a method of estimating the amount of biotin by the growth of *Ashbya gossypii*. The biotin content of a number of substances, including molasses, brown sugar, white sugar, egg yolk, and liquid manure, has been determined.

Work has been initiated also on the identification of the material or materials responsible for the beneficial effect on the growth of excised tomato roots of light brown sugar as compared to pure cane sugar. The material primarily concerned has been identified as vitamin B₆. A further study of the importance of this vitamin in plant growth is under way.

ROBBINS, WILLIAM J. (with SCHMIDT, MARY B.). Preliminary Investigations of Biotin. Bull. Torrey Bot. Club (in press).

— 1939. Vitamin B₆, A Growth Substance for Excised Tomato Roots. Proc. Natl. Acad. Sci. 25: 1-3.

— Further Studies on Excised Tomato Roots. Amer. Jour. Bot. (in press).

ARTHUR E. RUARK, University of North Carolina

Grant No. 162 (1937). Cloud chamber investigations of collisions between electrons and light nuclei.

Most previous workers on collisions of electrons with light nuclei in the gas of a cloud chamber have reported that electrons having an energy of a few million volts lose energy much more frequently than theory predicts. Specifically, they found that losses greater than 20 per cent of the initial energy are several times more frequent than one would expect from application of a formula due to Bethe and Heitler. This is a matter of great interest, if true, for there are good indications that the same formula works very well indeed in the cosmic ray region, up to energies of about 100 M.E.V. (million electron volts). H. R. Crane and his co-workers have attacked the problem in another way, by studying the energy losses of electrons which pass through plates or foils of material placed in a cloud chamber; Rose and Bethe have lent their aid in the interpretation of such experiments, which is made difficult by the fact that the average electron experiences many collisions in the solid scatterers employed. Speaking in a broad way, the conclusion of Crane is that the actual average energy losses are only slightly higher than the calculated ones.

Creighton C. Jones, Forrest Western, and the writer have attacked the problem again, by the observation of collisions occurring in the gas of the chamber. This is the most direct method but the accumulation of data is time-consuming. The work of taking photographs is negligible; measurement of the photographs is the factor limiting progress, so we have built a machine which gives stereoscopic views of the electron tracks and which has suitable scales and attachments for making quantitative measurements on them. Sixteen hundred photographs were taken with air in the chamber, using electrons having an energy between 0.4 and 2.4 M.E.V., which were produced by the gamma rays of ThC'' . On 400 meters of useful track there were about 350 electrons which were scattered by nuclei through an angle greater than 10 degrees, but only 50 were suitable for accurate measurements. In the study of these events the measuring apparatus proved its worth, but ways of improving it were seen. It has been rebuilt, and we are ready for extensive measurements with nitrogen in the chamber.

Fifty events constitute too narrow a basis for drawing final

conclusions, but certain points are clear. First, the chief complicating factor in these experiments is multiple scattering of the electrons in the gas of the chamber. At the energies with which we deal, apparent losses up to 20 per cent of the initial energy, E_0 , may be spurious losses instead of true radiative ones. It is safest to restrict our remarks to events in which the loss is greater than $0.5 E_0$.

The data from the 1,600 air photographs are subject to future revision, but will be presented in comparison with the results of others and with calculated values. Let R be the ratio of the number of losses greater than $0.5 E_0$ to the number of scattering events (the angle of scattering being greater than 10 degrees, and E_0 being greater than 0.4 M.E.V.). Then we have the following values:

	Chamber-gas	R
Present work	Air	< .02
Klarman and Bothe	Kr	.10
Klarman and Bothe	Xe	.125
Theory, $E_0 = 0.8$ M.E.V.	—	.01
Theory, $E_0 = 1.53$ M.E.V.	—	.04

The theoretical values are independent of atomic number in the approximation used here. The data of Klarman and Bothe, and our own data, are too scanty to justify splitting them into energy-classes; their work, like ours, was done with ThC" gamma rays, but due to differences in the experimental arrangements their average energy is about 1.6 M.E.V. while ours is about 1 M.E.V. Champion found no evidence of radiative losses for the beta-rays of radium E , but their average energy is much smaller; losses of considerable magnitude should be too infrequent for detection in the cloud chamber under his conditions.

The importance of multiple scattering in the gas makes it imperative (1) to make errors of measurement small, and (2) to adopt rigid criteria as to the quality of the tracks measured. The first desideratum has been achieved; as to the second, criteria for track-selection have been adopted arbitrarily by all previous workers in the field. We hope to put the matter on a logical basis soon, by suitable calculations on the effect of multiple scattering.

Several authors have suggested that discrepancies between the experimental and theoretical cross sections for radiation and for

scattering require fundamental modifications in the Dirac theory. Others have suggested that such discrepancies are due to non-Coulombian interaction between the electron and the nucleus. While such specific interaction may play a part in very close collisions, we believe that the main factors in the explanation are simpler and more obvious ones, namely, experimental difficulties, together with inadequacies of the existing formulas. Indeed, numerical work by Hulme shows clearly that the Born approximation gives results which are much too low in the case of large fractional loss of energy.

A brief account of this investigation was read before the National Academy of Sciences at its autumn meeting, Oct. 1938. (See abstract, *Science*, vol. 88, p. 478, No. 18, 1938.)

WILLIAM BERRYMAN SCOTT, Princeton University

Grants No. 4 (1934), No. 45 (1935) and No. 205 (1938, with Glenn L. Jepsen). To prepare a monograph on the fossil mammals of the White River formation in Dakota and Nebraska.

Researches under the grant made me in 1934-1935, for the preparation of a monograph on the Mammalian Fauna of the White River Oligocene, were continued steadily during the year 1938. Two parts have already been published, both in the TRANSACTIONS of the Society. The first part by W. B. Scott and Glenn L. Jepsen on the Insectivora and Carnivora, 153 pages of text and 22 plates, was published in 1936. Part 2 by Dr. Albert E. Wood on the Rodentia, 109 pages of text and 11 plates, was published in 1937. Part 3 on the Lagomorpha, also by Dr. Albert E. Wood, has been ready for the printer for some time, but has been held back because it was thought insufficient in volume to warrant separate publication. It will therefore be combined with Part 4 on the Artiodactyla by W. B. Scott, which is nearly completed, both text and drawings, and will, I trust, be ready for the printer in six weeks or less. The final part, Part 5, on the Perissodactyla, has also been largely completed and, barring accidents and illness, will assuredly be finished before the end of the current year. I shall be disappointed if the work is not entirely finished by June next.

GEORGE H. SHULL, Princeton University

Grant No. 77 (1935). Genetical and cytological studies in *Oenothera lamarckiana* and its derivatives.

Report read at General Meeting of the American Philosophical Society, April 22, 1937.

F. J. M. SICHEL, University of Vermont

Grant No. 180 (1937). The excitation properties of the contractile mechanism in skeletal muscle.

In the isolated skeletal muscle fibre preparation (frog) electrical stimulation usually excites the contractile mechanism directly without involving the conductile mechanism. To study the excitation of the contractile system and the changes in its excitability following a response, the fibre was stimulated with pairs of shocks and the peak isometric tension developed was recorded. The pairs of shocks were either simultaneous but differing in position along the fibre, or were applied to the same point but at different times. The first method of stimulation confirms the finding that spatial summation can occur in this preparation and further supports the view that a twitch-like response can be obtained without involving a propagated disturbance. The qualitative relation between the peak isometric tension, the strength of the shocks, and the configuration of the electrode system suggests that the results can be accounted for on the basis of a summation of the electrical stimuli or of the consequent local state of excitation which leads to the mechanical response. The second method of stimulation shows that temporal summation may also occur in the isolated fibre. If the interval between two equal shocks is less than about 0.003 second the isometric tension developed is greater than twice that due to a single shock. This indicates that the summation is of a local excitatory process which reaches a maximum at or very shortly after the moment of stimulation. This local state of excitation decreases rapidly at first, then more gradually, reaching the resting level in about 0.03 second. The results indicate further that the graded responses of the isolated fibre elicited without involving the propagated disturbance are not associated with a refractory period. The refractory period and the propagated dis-

turbance are closely related, and the absence of the refractory period allows additional stimulus above the threshold level to produce additional excitatory change and consequently a graded response.

V. M. SLIPHER, Lowell Observatory

Grants No. 16 (1934) and No. 161 (1937). The systematic search of the wide ecliptic belt of the sky for more distant planetary members of the solar system.

SLIPHER, V. M., 1938. The Trans-Neptunian Planet Search. *Proc. Amer. Philos. Soc.* 79: 435-440.

T. M. SONNEBORN, Johns Hopkins University

Grants No. 178 (1937) and No. 270 (1938). Sexuality and genetics in *Paramecium aurelia*.

With the aid of the first grant, two extensive investigations were completely carried out and several others begun. The first investigation dealt with the occurrence, number and interrelations of mating types in 34 stocks of *P. aurelia* and with the conditions required for the sex reaction and conjugation. The 34 stocks were collected between North Carolina and Massachusetts and from California. Among these stocks, six mating types (I, II, III, IV, V, and VI) were found. Mating occurs only between types I and II, between III and IV, and between V and VI. Any one stock consists either exclusively of one mating type or of two types that interbreed. There are thus three groups of stocks: one group contains types I and II, one contains types III and IV, one contains types V and VI. As these groups of stocks are completely isolated sexually and as they differ in certain physiological characteristics, they form three physiologically distinct varieties of *P. aurelia*. The two mating types (I and II) in variety 1 react sexually at any hour and at all temperatures investigated (9° to 32° C.); the types (III and IV) in variety 2 react only between 6 P.M. and 7 A.M. and only below 24° C.; the types (V and VI) in variety 3 react only between 1 A.M. and 1 P.M. and only below 27° C. In variety 3 the diurnal periodicity is due to the suppression of sexual reactivity by visible light.

The second investigation dealt with a newly discovered interaction between diverse races and species of *Paramecium*. Three races of variety 2 of *P. aurelia* were found to alter the fluid in which they live so as to make it lethal to certain other races of *P. aurelia* and to certain other species of *Paramecium*. Two of these races produce essentially the same kind of lethal action: suppression of feeding and growth; accumulation of body crystals; destruction of endoplasm; violent spinning about the longitudinal axis; and finally, death. Effects are first evident two to four hours after contact with the lethal fluid; and death follows in two to four days. This lethal fluid affects all races of varieties 1 and 3 strongly and quickly; affects all races of variety 2 more slowly and weakly; and also affects *P. calkinsi* strongly.

The lethal fluid produced by the third race suppresses feeding and growth, vacuolates the endoplasm, slows up locomotion, and finally kills. Its effects are first evident in about 12 hours and death follows in 16 to 36 hours. It acts quickly and strongly on all races of varieties 1 and 3 and on some races of variety 2, but other races of variety 2 are more resistant and some are completely immune. It also acts strongly on *P. calkinsi* and *P. multimicro-nucleatum*, less strongly on *P. trichium*, not at all on *P. bursaria*. This lethal fluid is active in very great dilutions but its activity is completely destroyed at once at 50° C. and more slowly at lower temperatures.

Other investigations, some of which were begun with the first grant, have been completed or are still in progress with the aid of the second grant.

1. *Simple Mendelian Inheritance*. By standard methods of genetic analysis it has been demonstrated that the production of only mating type I in a stock is due to the homozygous recessive condition of one pair of genes (aa), while the production of both types I and II is due to the presence of the dominant allele (A) in homozygous or heterozygous condition.

2. *Effect of Temperature on Production and Inheritance of Types V and VI*. These two mating types are determined by the macronucleus. The type determined by any macronucleus is influenced by the temperature prevailing at the period when the macronucleus is formed from the micronucleus: the higher the temperature, the greater the percentage of macronuclei determining type

VI. After this temperature-sensitive period, the mating type is strictly inherited by all subsequent macronuclei produced at later fissions, regardless of temperature.

3. By mating stocks that lack micronuclei to stocks that contain them, it has been demonstrated (a) that the nuclei are exchanged between mates in conjugation; (b) that the genetic characters are determined ultimately by the micronuclei through the mediation of the macronucleus and cytoplasm; and (c) that stocks homozygous for gene A can produce either mating type I or II with the same haploid chromosome set.

Reports of parts of the preceding investigations were presented at the 1938 open meeting of the American Philosophical Society and at the 1938 Richmond meeting of the American Society of Zoologists.

SONNEBORN, T. M., 1938. Mating types in *Paramecium aurelia*: diverse conditions for mating in different stocks; occurrence, number and interrelations of the types. *Proc. Amer. Philos. Soc.* 79: 411-434.

——— 1938. Mating types, toxic interactions and heredity in *Paramecium aurelia*. *Science* 88: 503.

HERTHA SPONER, Duke University

Grant No. 130 (1937). Investigation of absorption spectra of polyatomic molecules, especially in the photographic infra-red.

1. The apparatus constructed under this grant consists of a stainless steel absorption tube 105 feet in length with inside mirror polish and the necessary illumination and spectroscopic equipment.

2. Absorption pictures have been taken in methylamine vapor in the photographic infra-red covering the region from 6,000-12,000 Å. Several absorption bands have been found, some with resolved rotational structure. From preliminary measurements it can be concluded that there is no free rotation in the methylamine molecule and that the moments of inertia are about 8×10^{-40} and 40×10^{-40} gr. cm.².

3. The absorption of N₂O has been studied in the ultraviolet and visible regions. Two continuous ultraviolet absorptions have been found, the first one probably corresponding to a forbidden and the second one to an allowed transition between electronic states.

WILLIAM C. STADIE, University of Pennsylvania

Grant No. 240 (1938). The chemical action of insulin upon the intermediary metabolism of isolated surviving tissue of the normal and pathological animal.

Tissues, either liver or muscle, were used for metabolic study *in vitro* as thin slices, minces or extracts. Equilibration was done for definite periods of time in buffered media (either without or with insulin) containing substrates. Tissues were also prepared after prior intravenous injection of insulin. The animals used include the normal rat, the adrenalectomized rat, the adreno-demedullated rat, the normal cat, the diabetic cat, the Houssay cat, and cats made diabetic by the prior injection of anterior pituitary extracts. The substrates include various amino-acids, as representative of the catabolic products of proteins; glucose, glycogen, and lactic acid, as representative of carbohydrate metabolites; and butyric and B-oxybutyric acids, as representative of ketones. The oxygen consumption, the carbon dioxide production, the urea and ammonia formation, the carbohydrate synthesis, the formation and oxidation of ketone bodies, and the total acid metabolism were determined by micro-chemical methods.

The major part of the work thus far is on the action of insulin upon the rate of deamination of amino-acids and the synthesis of carbohydrate by the liver, and the influence of insulin thereon. In addition, studies on the total acid metabolism and ketone formation of the liver have been made. The conclusions thus far reached are:

1. In the normal rat or cat, insulin does not inhibit the deamination of the L- (or naturally occurring) amino acids. On the other hand, the deamination of the stereoisomeric D-isomers of these acids (so-called "non-natural" forms) is inhibited. In the diabetic cat, there was found a marked increase of the rate of deamination by the liver. This fact relates the increased protein metabolism of the diabetic to the increased activity of the deaminases of the liver. Further, the inhibitory action of insulin on deamination suggests a possible mechanism for the action of insulin in decreasing this excessive protein metabolism.

2. In the normal rat or cat, insulin was found to have no influence upon the new-formation of carbohydrate by the liver. In the diabetic cat liver, the rate of synthesis of carbohydrate from non-

carbohydrate sources was found to be diminished rather than increased. Furthermore, no enhancement of the action of insulin either upon deamination or carbohydrate synthesis was found in the diabetic cat liver. These findings are not in accord with the current view that diabetes is associated with an excessive glyconeogenesis by the liver from non-carbohydrate sources.

3. The influence of the pituitary upon protein metabolism is indicated by the fact that in the Houssay cat (in contrast to the diabetic cat) there were found normal rates of deamination by the liver. Further, in a series of cats made diabetic by prior injection of anterior pituitary extract there were found, in some but not all cases, very high rates of liver deamination. In this case there were also observed marked inhibition by insulin of deamination.

4. Krebs' observation that insulin causes an increased oxygen uptake by normal pigeon muscle was confirmed, and attempts are being made to determine the metabolite whose oxidation is being catalysed by insulin.

5. Preliminary observations indicate that the diabetic cat liver produces ketones far in excess of the amount excreted. This indicates that the diabetic animal is capable of burning large amounts of these bodies. Studies are in progress to show a possible role of insulin in the control of this excess ketosis.

6. A method has been devised by which the total acid metabolism of tissues *in vitro* can be determined by a simple determination of the pH of the medium by the glass electrode.

STADIE, W. C. (with LUKENS, F. D. W., and ZAPP, J. A.). The Action of Insulin in Vitro. I. The Effect of Insulin Upon the Respiration, Urea and Ammonia Formation, and Carbohydrate Synthesis by Liver Slices of the Normal and Diabetic Animal. Approx. 20 pp. (Submitted to Jour. of Biol. Chem.)

JOEL STEBBINS, University of Wisconsin

Grant No. 123 (1936). Development and improvement of photoelectric amplifier; application to photometry and colorimetry of stars; study of space-reddening, and of dimensions and constitution of the galaxy.

A grant for the further development of photoelectric photometry is being used to construct a differential photometer for use on the 15-inch refractor of the Washburn Observatory.

This device has involved a major operation on the telescope. The main tube was taken down and the diaphragms enlarged. A

new tailpiece was constructed and now it is possible to reach two stars simultaneously up to two degrees separation in the sky. The completed photometer including prisms, lenses, photocell, and amplifier is now in working condition on the telescope, and only needs some more tests before we can embark upon a long program of observations.

Instead of five or six minutes between measures of two stars, the new device gives alternate readings at intervals of a few seconds, so the effect of changes in the transparency of the air will be largely eliminated. There is every reason to believe that this new instrument will give more precise results than we have ever secured before.

LESTER WILLIAM STROCK, University of Oslo

(now Research Laboratory, Saratoga Springs Commission)

Grant No. 142 (1937). Study of geochemical distribution of the chemical elements by means of quantitative spectrum analysis.

An abstract of the general features of a quantitative spectrum analysis method for determining silver in geological materials was reported one year ago. In applying this method to a study of the geochemistry of silver, it was found that the photographed spectrum background seriously affected the accuracy of the analyses when faint lines were employed, i.e. when the concentration of silver being determined was very low. The nature of this difficulty has been illustrated in previous papers by the author ("Spectrum Analysis by the Carbon Arc Cathode Layer Method," London 1936, p. 39; and "Zur Geochemie des Lithiums," *Nach. der Ges. Wiss. Göttingen*, N. F. 1, page 171. 1936). Since other workers have experienced similar trouble it was decided to make a systematic investigation of the manner in which the background affects the density of photographed line spectra, and if possible to find a correction for it. This investigation is not yet completed, but from the experimental work, which was supported by a grant from the Penrose Fund, two papers have already been published.

I. The Background Effect on the Density of Photographed Line Spectra (A Preliminary Paper). *Tidsskrift for Kjemi og Bergvesen* (Oslo), No. 6, 1938.

It has been shown that the observed decrease in the slope of the blackening curve (density:log exposure time) of a narrow stepped

spectral line which lies in a background, is a result of the *Eberhard* ("Nachbar") photographic effect. Because of this effect, the blackening curves for narrow lines are steeper than for larger emulsion areas when the development time is shorter than necessary for complete development. As the density of a line lying in a constant background decreases, the slope of its blackening curve drops systematically to that of the continuum. The blackening curve of an emulsion, as determined from narrow lines, is thus influenced by two opposing factors: one increasing the true slope (*Eberhard Effect*), the other decreasing the line-slope when a background is present (*Fog Effect*). These two factors contribute to the background effect in spectrum analysis. Experiments with 2 mm. wide lines superimposed (intermittent exposures) on a continuous background indicated a dependence of the rate of development on intensity level of exposure which is also part of the background effect.

II. Contribution to the Knowledge of the Photographic Latent Image and Development Process. (Skr. Norske Vid.-Akad. Oslo, Mat.-Naturv. Kl. 1938, No. 10, pp. 1-82.)

Part A. A dependence of the rate of development of an exposed photographic emulsion on intensity of light involved in the exposure, has been established. Exposures at low intensity levels develop to their maximum density faster than do equal exposures (*IT*) at high intensity levels.

Part B. The intensity retardation of development effect, of Part A, provides a ready explanation of the known effect of the extent of development on curves of constant density ($\log IT : \log I$) "reciprocity curves." The minimum point of these curves locates the intensity at which the emulsion utilizes light most efficiently. True "optimum intensity" is only obtainable when all developable AgBr has been reduced in the development process (complete development). The high intensity branch of these curves is lifted to higher $\log IT$ for incomplete development, than is the low intensity branch. "Optimum intensity" therefore shifts to lower intensities.

An analytical treatment of the original curves of E. Kron (1913) from this point of view has yielded an equation relating the intensity-development "lag" $\Delta(1 - Dt/Dm)$ to intensity. The vertical separation ($\Delta \log IT$) of E. Kron's curves provides the experimental data involved, which were converted to intensity lag by theoretical

curves derived from schematic $D:\log E$ curves. The $\Delta(1 - Dt/Dm)$ values so obtained permitted the calculation of the developing rate constant k_1 of Kron's development process for each intensity, from which *curves of constant development time* were constructed. k_L is the developing (fastest) rate constant at low intensity I_L , and k_H that above the critical higher intensity I_H .

The experimental $(k_L - k_I) = x:\log I$ curve is expressed exactly by the equation $x = b \cdot e^{-cI}$. The *intensity retardation of development effect*, $R = k_L/k_H = k_L/k_L - b$, is the necessary increment in development time required for exposures at I_H to develop to the same Dt/Dm as exposures at intensity I_L .

Part C. The intensity retardation of development effect has been shown to be a photographic consequence of an increase in the *effective* absorption coefficient of the AgBr grain for "highly quantized" radiation. Light of low intensity is thus usefully absorbed in the outermost layers of the grain only, whereas equal exposures (IT) at higher intensity of illumination penetrate deeper into the grain.

The grain is subdivided into distinct mosaic blocks, each of which reacts separately to light and the developing solution. A light quantum absorbed (by AgBr?, impurity, or dye) anywhere within a block releases an electron, which eventually reaches a block surface where it may combine with a surface-silver ion to form an "excited" Ag atom. This is the *latent image*. A photographic chemical developer is capable of reducing this already partially reduced Ag ion (but not normal Ag ions). The resulting neutral silver atom located in a AgBr lattice position initiates an *auto-catalytic reduction process*, which continues until the entire block is reduced. The rate of reduction is determined by the number of development centers (reduced "excited" Ag atoms) from which the process started. The rate of development of progressively deeper blocks decreases in exactly the same proportion as the number of light quanta reaching these deeper blocks decreases. The intensity retardation of development effect, is thus due to a rapid reduction of the outer blocks of the grain from many development centers for low intensity; whereas at high intensity the same number of development centers tend to be distributed over all blocks of the grain, so that maximum density is reached more slowly.

Not only is the position of "optimum intensity" (Part B), and the intensity dependence of the rate of development due to a dif-

ference in the depth of the grain rendered developable, but this same factor is one of the two causes of the *reciprocity law failure* itself. Consequently, "optimum intensity" and minimum development rate k_E are obtained at approximately the same intensity, since both represent the intensity at which "excited" atoms are first produced on the deepest blocks. This block-wise reaction of the grain to light and developer, in combination with the grain depth illuminated at different intensities (for the same IT), leads to a unique explanation of other photographic effects, i.e. (1) effect of oxidizing agents on exposed grain, (2) general shape of blackening ($D: \log E$) curve, (3) dependence of D_m on intensity, (4) super-sensitive grains, (5) dependence of γ on the type of emulsion and wavelength.

The normal photoelectric properties of metals has been applied to single mosaic blocks of the AgBr crystal. An "excited" silver atom is formed only if the energy of the photoelectron does not exceed a critical amount on reaching the grain surface. If so, it moves into a neighboring block, except for exterior blocks from which it escapes entirely from the grain and is lost for the photographic process. There is no fundamental difference between the *normal* (outer) and *inner* photoelectric effect. The crystal photo effect is also a manifestation of the mosaic block structure of crystals.

The loss of photoelectrons from the exterior surface of the grain (normal photoelectric effect) is a second cause of the reciprocity failure. The magnitude of the loss from this cause is illustrated qualitatively by photoelectron distribution curves for metal layers of various thickness. Only those photo-released electrons which reach the block surface with energy corresponding to the energy level of the "excited" atom surface state are photographically useful. The energy of the maximum number of electrons released by low intensity exposures lies above the zone of useful energy, and vice versa for high intensity.

Two factors contribute to the reciprocity failure:

1. Light quanta do not illuminate the entire volume of the grain (low intensity) or else pass through unabsorbed (high intensity).
2. A loss of photoelectrons due to the normal photoelectric effect on outer grain blocks (especially serious at low intensity).

The temperature dependence of photographic efficiency is due

to the change in kinetic energy of the photoelectrons for the temperature change involved. An increase in temperature increases the loss of photoelectrons from the exterior blocks, so that low intensity exposures are still less efficient.

The effect of temperature on the fraction of photo-released electrons which really contributes to the photographic effect, has been illustrated by a schematic modification of the energy distribution curves for thin layers of metallic silver. It is shown that a linear relation between temperature and photographic effect must exist at low and high intensities. The temperature coefficient of sensitivity at low intensity must be numerically greater than for high intensity—being negative at low intensity and positive for high intensity, passing through an inversion point at intermediate intensity. It is shown that there is direct physical evidence in support of the photochemical production of "excited" Ag atoms in Ag halides (as distinct from neutral Ag atoms). The two types of reversal of the latent image are attributed to the two types of F-center destruction in alkali halides; i.e. *Solarization*—"Erregung," and *Herschel* effect=irreversible destruction of F-centers (Hilsch and Pohl). In the alkali halides F'-centers are neutral atoms, and F-centers are "excited" atoms (in lowest p-level). There is no necessity for postulating any pre-existing agent to concentrate the photochemical product on the grain surface, in order that development can start at distinct "specks." *The latent image consists of "excited" Ag atoms on any, or all, mosaic block surfaces of the grain.* This theory accounts for the entire empirical data of photography and provides a convenient atomistic picture of all photographic effects. These new concepts of the photographic process were evolved entirely to account for the *intensity retardation of development effect.*

III. The revised spectrum analysis method for making quantitative determinations of small amounts of lithium, reported last year, has been applied to a study of the distribution of this element in the various rocks and rock minerals of the Oslo petrographic province. Spectra of nearly 200 different samples have been photographed, the necessary lines photo-metered, and Li content determined.¹

The remaining experimental data on the background effect and other theoretical aspects of photography of importance for the

¹ My wife has done considerable part of the technical work involved in this study. The results are now being prepared for publication.

application of spectrum analysis to geochemistry will be published as soon as possible. The final report of the research carried out by the aid of this grant will be submitted next year.

STOCK, LESTER W., 1938. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1937: 236-237.

ALBERT TYLER, California Institute of Technology

Grant No. 144 (1937). Investigation of the action of various metabolic stimulants and depressants on the rate of respiration and development of eggs of marine animals.

This work included experiments on (A) the respiration and life span of unfertilized eggs under sterile conditions, (B) the action of substituted phenols in stimulating the respiration of marine eggs.

(A) The increase in rate of oxygen consumption, which is exhibited by aging unfertilized eggs of marine animals, can be accounted for by the bacterial growth which accompanies the disintegration of the eggs. This is shown by experiments in which the respiration is measured under sterile conditions, by use of such agents as alcohol which prolong the life span of the eggs, and by determinations of the respiratory rate of marine bacteria. The respiration is not depressed by alcohol in concentrations that give an extension of the life span of the eggs.

The life span of the unfertilized sea-urchin egg is approximately doubled in 2 per cent alcohol. Sterile conditions give an increase of about four to seven times, but alcohol in sterile cultures does not further prolong the life of the egg. Addition of heavy suspensions of bacteria results in a small decrease in the life span. Alcohol in heavy bacterial suspensions is measurably oxidized to acid which soon kills the eggs. It seems likely that it is the smaller amount of acid produced from the alcohol in the ordinary cultures that is the effective agent. Consistent with this acids are now found to give a more than three-fold increase in the life span of *Urechis* eggs. The result may be obtained at the pH of ordinary sea-water if a weak acid is employed. The action of cyanide, anaerobiosis, carbon monoxide, dextrose and dinitrophenol

which also increase the life span of the egg can be explained as due to acid effect.

The results show that there is a period during which the egg is immune or resistant to bacterial action. Increasing the life-span under non-sterile conditions, involves extending this period.

(B) The large number of substituted nitro- and halophenols which, principally from the work of Clowes and Krahle, are known to stimulate the respiration of marine eggs, exert their optimum effects in widely different concentrations. In order to get at the relation between the molecular structure of these compounds and their physiological activity as well as their mode of action in the cell, it is important to determine whether it is the undissociated molecule or the anion that is the active form. To examine this question, the concentrations required for optimum respiratory stimulation and reversible cleavage block in fertilized sea-urchin eggs were determined for fifteen different nitro- and halophenols. The experiments were also run at different pH's the discovery of a suitable sea-water buffer, glycylglycine (Tyler and Horowitz 1937), making such work readily feasible. From an examination of the effect of altering the pH with any given substituted phenol and from a comparison of the different substituted phenols on the basis of the calculated concentration of molecules and of anions inside the cell the conclusions are reached that the anion is the active form while penetration is accomplished in the undissociated form. This view is also supported by experiments in which the internal pH is altered.

- TYLER, ALBERT, 1937 (with HOROWITZ, N. H.). The Molecular Species Concerned in the Action of Substituted Phenols on Marine Eggs. *Biol. Bull.* 73: 377-378.
- 1937 (with RICCIO, N., and HOROWITZ, N. H.). Respiratory Rate and Length of Fertilizable Life of Unfertilized *Arbacia* Eggs under Sterile and Non-sterile Conditions. *Biol. Bull.* 73: 395-396.
- 1938 (with HOROWITZ, N. H.). The Activities of Various Substituted Phenols in Stimulating the Respiration of Sea Urchin Eggs. *Biol. Bull.* 75: 209-223.
- 1938 (with RICCIO, N., and HOROWITZ, N. H.). The Respiration and Fertilizable Life of *Arbacia* Eggs under Sterile and Non-sterile Conditions. *Jour. Exp. Zool.* 79: 129-143.
- 1938. Report of Progress. *Yr. Bk. Amer. Philos. Soc. for 1937*: 208-209.

THE UNION LIBRARY CATALOGUE OF THE PHILADELPHIA
METROPOLITAN AREA

A special grant of \$7,500.00 was approved by Council in December, 1935, for expert work in the production of a Union Catalogue of the Libraries in the Philadelphia Metropolitan Area.

Grant No. 116 (1936) of \$2,500.00 (an equal amount was appropriated by each of the Committees on Publication and Library making a total of \$7,500.00).

Grant No. 177 (1937) of \$6,000.00 for three years.

The work of compiling and editing the Union Library Catalogue, which embraces not only the major and many minor libraries of the city of Philadelphia but extends its scope from Chester to Pennsburg and from Villanova and West Chester to Bryn Athyn and Newtown, has made steady progress during the past year.¹ Filing of cards into the Catalogue was completed in July, after twenty-nine months of actual work. While still in only provisional alphabetical order and requiring much further editing, the Catalogue is practically useful and is in fact in daily and increasing use. It is safe to estimate that in 95 per cent or more of the cases the Catalogue contains a record which for purposes of identification is as accurate as the record in individual libraries. In a very large percentage of cases the Catalogue contains a better card than the library from which the record was taken. This improvement is accomplished through two phases of the editorial work: (a) When several libraries contain the same book, though it may not be described in precisely the same way in their several catalogues, the Union Catalogue records all these holdings of an indisputably identical edition on the best card, thus bringing the record, for any one title, up to the level of the best card in any library in the Philadelphia Metropolitan Area which records the book. Many titles are thus recorded in the Union Catalogue on a printed Library of Congress card, though some of the local libraries may have used less adequate cards of their own making for this item in their own catalogues. (b) The Union Catalogue staff has worked over in detail many problematic sections of the Catalogue—such as BIBLE, SHAKESPEARE, PHILADELPHIA, PENNSYLVANIA, UNITED

¹ A folder entitled "Union Library Catalogue of the Philadelphia Metropolitan Area, a Statement of Facts" has been widely distributed and copies may still be obtained in any desired quantity upon application to the Union Library Catalogue, The Historical Society of Pennsylvania.

STATES, SMITH, JONES, BROWN, FRANCE, PARIS, SOCIETY, AMERICA, and the like, and including many smaller sections—and put them into adequate final condition according to the standards of the Union Library Catalogue. Thus a considerable amount of research and careful comparative study are resulting in clarification throughout the file.¹

While the Union Library Catalogue is intended primarily for the quick and convenient location of desired books in our numerous and scattered libraries, it is also planned so as to serve other purposes as well. It was early perceived that such a central file might be a great aid in simplifying the expensive task of recataloguing some of the older local libraries and that its existence might bring about interesting and desirable modifications in certain phases of cataloguing technique. The Library Company of Philadelphia has been the first to take advantage of the opportunity thus afforded in a comprehensive scheme for a new catalogue, work on which was actually begun in October, 1938. The method employed, at a tremendous financial saving to the Library Company and its Ridgeway Branch, would be impossible without the use of the Union Catalogue as a basis for this work. Details of the operation and the results achieved can better be reported after this interesting undertaking has made further progress. The Philadelphia Museum of Art Library has also undertaken, not so much a new catalogue, as a new and experimental system of cataloguing which is wholly inspired by the Union Catalogue and dependent upon it.

The principal work to be done within the Union Catalogue itself for some years to come will consist of editorial revision for the improvement of the filing order and the form of entry of the cards and for the solution of the many bibliographical problems of identification which inevitably arise as such a quantity of material is assembled in a single file. But even in its present condition the Catalogue is well serving its primary purpose of assisting individuals and institutions in the location of titles, and a noteworthy number of inquiries receive a prompt and affirmative answer. A record of inquiries is being kept and will serve as the basis of a

¹ For further details on this bibliographically interesting side of the work, and for lists of the sections so far edited, reference may be made to the unpublished annual reports of Mr. Arthur Berthold, Bibliographer, to the Director of the Union Library Catalogue.

statistical survey of the actual use of the Catalogue at the end of its first three years of operation. On an average day at present there are perhaps twenty-five inquiries by telephone or mail, but on a "busy" day the number rises considerably higher. Many searchers consult the Catalogue in person, often in connection with a research problem, for several days in succession. The Catalogue has a number of "steady patrons" who come regularly to consult it in the course of their work. There are also several routine inquiry lists, such as those of the University of Pennsylvania Library and the national weekly lists which are circulated by the Union Catalogue at the Library of Congress. Long search lists for various bibliographical projects have begun to make their appearance. The Survey of American Imprints of the Historical Records Survey has maintained a staff of copyists at the Union Library Catalogue for somewhat over a year. A group of scholars concerned with legal history have searched at length in the Catalogue, and in the films of local catalogues from which it was compiled, for items relating to the bench and bar in Pennsylvania. The Catalogue may also prove to be of great practical assistance to the interesting project of the Special Libraries Council for an up-to-date bibliography of Philadelphia. Many WPA projects make regular and constant use of the Catalogue, as do also the universities and colleges of the community. To bring the Catalogue to the attention of potential users at the moment when it will be of greatest interest to them, a guide card describing briefly its facilities has been printed for insertion in the trays of local catalogues, and it has been cordially accepted by most of the local libraries which are included in the Union Catalogue.

Technical experiments to devise means of avoiding unnecessary duplication in the copying and recopying of cards are now being made. Still other experiments, directed towards a possible subject-approach to books through a central file, are also in progress, but it is too early as yet to report at all fully on them.

It is very gratifying to note that the success of the Philadelphia Catalogue has given an important impetus to the now nationwide tendency to undertake local union catalogues. Well-timed to take advantage of Federal relief labor, and far better provided with local funds and support than most such undertakings, the Union Library Catalogue of the Philadelphia Metropolitan Area may quite properly be said to be serving as a model for enterprises of its kind.

The administrations of practically every union catalogue now in progress, or projected, have conferred with our office in Philadelphia, and the methods and practice worked out here have often been a direct influence with them. Miss Eleanor Campion, a former member of the Philadelphia Catalogue staff, is now in charge of the Union Catalogue of the State of Nebraska at Lincoln, and she is preparing a working manual of procedure which will doubtless be widely used. Miss Lilian Jeffreys of Christchurch, New Zealand, has recently been engaged in editorial work for the Library Company of Philadelphia at the Union Catalogue, as a means of preparing herself for work on a proposed union catalogue in her own country. Authorities in charge of plans for a union catalogue of greater New York have inspected the records and the workings of the Philadelphia Union Catalogue in detail. There has been much correspondence with many other interested parties and the Philadelphia Catalogue continues to be examined by visitors from all over the world.

Of publications by members of the Union Library Catalogue staff the only items to report are:

BERTHOLD, ARTHUR B., 1938. Editing a Union Catalogue. *Library Journal* 63: 222-223.

DAVID, C. W., 1938. Report of Progress. *Yr. Bk. Amer. Philos. Soc. for 1937*: 216-218.

but the following articles in which the Philadelphia Catalogue has been discussed may well be cited:

BISHOP, W. W., 1938. Resources of American Libraries. *Library Quarterly* 8: 467-470.

CONEY, DONALD, 1938. A Brief Account of the Principles and Formative Period of the Union Library Catalogue in Philadelphia. *Library Quarterly* 8: 550-552.

MACDONALD, M. B., 1937. Existing Union Catalogue Projects, with Special Reference to those at the Library of Congress and in Philadelphia. *Pacific Northwest Library Association Quarterly* 2: 30-32.

UNIVERSITY MUSEUM, UNIVERSITY OF PENNSYLVANIA,
H. U. Hall

Grant No. 71 (1935). Ethnological study of the Sherbro of Sierra Leone, British West Africa, their customs, their industries and art.

HALL, H. U., 1938. The Sherbro of Sierra Leone: A Preliminary Report on the Work of the University Museum's Expedition to West Africa, 1937. Univ. Press, Univ. of Pa., pp. v, 51.

— 1938. Report of Progress. *Yr. Bk. Amer. Philos. Soc. for 1937*: 161-163.

THE UNIVERSITY MUSEUM, UNIVERSITY OF PENNSYLVANIA,
Linton Satterthwaite, Jr.

Grant No. 151 (1937). Archaeological excavations at the Maya Old Empire site Piedras Negras, during the seventh field season, 1937.

1. The simple double-range palace type (i.e. without end rooms) was identified with reasonable certainty on the earliest of six Acropolis building levels, and also in the probably earliest vaulted palace on the latest level; in this latter instance, with subsequent alteration to provide the end room. The simpler type was also identified in the South Group, with non-vaulted roof. On analysis of all palace plans it is concluded that the transverse end room is a late importation, probably from the Peten, but that the simple double-range type was established at an early date.

2. Knowledge of the designs of temple building platforms and temple pyramids was greatly extended. It appears that Peten stylistic influence on Piedras Negras architecture was very strong from the time of the earliest dated monuments (circa 9.5.0.0.0 in the Maya calendar). Some of this information requires reconstruction of non-vaulted temples with complex Peten plans. This tends to confirm the theory that beam and concrete roofs, rather than thatch, immediately preceded the masonry vaulted roof. Two of these non-vaulted temples probably had massive roof combs placed to the rear, as at Tikal. A rectangular inset corner was found stratified above an inset round corner.

3. The stucco masks of temple Pyramid No. K-5 were shown to pertain to the latest of three superimposed temples, previously found. The earliest temple (consisting of a room much larger than any other known in the Maya Old Empire) was shown to have no side outset. Further excavation will probably show it to be a simple rectangle in plan. The Peten architectural influence, so clear on all temples on the surface, probably was weak or non-existent at the beginning.

4. Discovery of a small crude plain stela in an early fill suggests that plain stelae accompanied the early buildings before carved monuments began to be erected.

5. All vaulted palaces and three of the six vaulted temples have been shown to post-date earlier constructions, further facts supporting the theory that vaulting reached the site, probably from the Peten, long after it had reached maximum size.

6. Further excavation in the palaces showed no evidence of domestic fires, or of sleeping accommodations. The number of known bench thrones and therefore throne rooms was greatly increased. The varying designs, constructions and placements strongly suggest that the single plain masonry bench encountered is also a throne. It has been generally believed that palaces were priestly domiciles, and it has been suggested that the characteristic benches were beds. Both suppositions seem negatived by the season's work. The throne rooms indicate that the function of the palace was probably public or semi-public, though different from that of temples. However, many galleries and rooms were devoid of thrones or other function indicators. The local distribution of table-thrones was extended to a probably fairly early non-vaulted palace in the South Group. The apparent original position of "Throne 2" was identified in a probably later non-vaulted palace. The date on this re-used fragment has been read as 9.11.10.0.0 (?). There is thus ground for believing that palaces were in part used for throne ceremonies during most or all of the period of dated monuments.

7. Column altars, all but universal in temple rooms, were found in position also before a pyramid stairway. A possible connection between this characteristic Piedras Negras feature and the somewhat similar stones found in northwestern Yucatan is rendered more plausible.

8. One of the thrones excavated was broken and parts of the seat and legs removed while the palace roof was still standing. Large numbers of potsherds, of the late type referred to below, were found on the floor of another palace, and are restorable to form whole vessels. Both circumstances tend to confirm the previously held belief that the city met a violent end as a ceremonial center.

9. Additional deposits of potsherds were sought and found in various stratified building fills; accurate cross-sections of all forms encountered were drawn. Subsequent analysis indicates two main pottery periods. The earliest, based primarily on shape, secondarily on decoration, beginning at bed rock in the West Group, includes polychrome rounded-bottom tripod flanged bowls, and slab feet; the latest includes polychrome flat-bottom tripod bowls and plates and cylinder jars. These periods seem to equate in a general way with the Tzakol and Tepeu pottery periods at Uaxactun,

Peten. Sherds of the later period were encountered in fill probably laid down at 9.17.15.0.0 in the Maya calendar. This fact and the position of the sherds referred to in (8) impels the belief that the ceremonial buildings were abandoned during a pottery period which had come into existence by 9.17.15.0.0.

10. A number of late and probably trade wares were encountered. Carved bowls are identical in form and design with bowls excavated in the mountainous Alta Vera Paz to the south; pottery drums are identical in form with others seen at Jonuta, near the Gulf coast to the north; an incised complex silhouette bowl type is the same as found in a tomb at Yoxiha, to the northwest. Two examples of "candeleros," of the type common at Teotihuacan, Valley of Mexico, were found in a terrace fill built after the first Acropolis building period, but otherwise undated. An elaborate hollow slab foot, probably fairly late, is similar to feet found in the Guatemala highlands and in the Valley of Mexico. No plumbate ware has as yet been found.

11. A hieroglyph in what has been claimed to be a Maya codex style was found painted on a late period vessel.

SATTERTHEWAITE, LINTON, JR., 1938. Maya Dating by Hieroglyph Styles. *Amer. Anth.* 40, No. 3.

CARL G. VINSON, University of Missouri

Grant No. 219 (1938). A chemical investigation of disease virus.

The average of many analyses places the nitrogen content of our virus fractions at about sixteen per cent, and the ash content at between one and two per cent. Sodium sulfate continues to be the salt primarily used in salting out the virus in the Stanley crystalline form. Solid aluminum sulfate ($\text{Al}_2(\text{SO}_4)_3 \cdot 18\text{H}_2\text{O}$) may also be used to obtain the same result when the virus is dispersed in a medium which will not give a precipitate with the aluminum sulfate. Obviously, aluminum sulfate cannot be used when the virus is dispersed in phosphate solution. Aluminum sulfate may be used to salt out the virus when the dispersing medium is M/3 sodium citrate.

X-ray diffraction patterns of crystalline-like tobacco mosaic virus protein prepared by the sodium sulfate method have been

obtained. The virus material was packed into a pasty mass by centrifuging, and placed in a flat cell of approximately optimum thickness and having faces of exceedingly thin-blown glass. This cell was placed in a gas-tight camera having 15.41 cm. as the perpendicular distance from the flat photographic film to the cell. Helium was passed through the camera to reduce gas scattering. Approximately monochromatic copper K radiation was secured through the use of a copper target tube and a thin nickel filter before the apertures for collimating the X-ray beam. Exposures were of the order of 100 hours. The diffraction patterns obtained with different samples were the same in essential features, though certain very weak lines appeared on some, but not on all patterns. The Bragg spacings, d , ranged from 2.43 Å to 14.3 Å, though spacing as large as about 50 Å could have been detected. The correlation of these spacings with those obtained by Wyckoff and Corey is not very good. In particular, the very large spacings are absent in the present material, and where practical coincidence is observed, the relative intensities of the lines are not comparable. Wyckoff and Corey do not record spacings less than 3.39 Å, whereas in the present work, a spacing of 2.43 Å is recorded. It is concluded that the crystalline-like virus protein material obtained by the present method has different and considerably smaller spacings than those of other materials, and hence is likely to have a lower molecular weight.

ALBERT T. VOLWILER, Ohio University

Grant No. 136 (1937). Preparation for publication of the correspondence between President Benjamin Harrison and James G. Blaine, his Secretary of State.

Papers were read on the general subject, "New Viewpoints in American Foreign Policy, 1889-1893," before the Ohio Academy of History, and before the Mississippi Valley Historical Association at its Memphis meeting.

- VOLWILER, A. T., 1938. Harrison, Blaine, and American Foreign Policy, 1889-1893. *Proc. Amer. Philos. Soc.* 79: 637-648.
——— 1938. Report of Progress. *Yr. Bk. Amer. Philos. Soc. for 1937*: 230-231.

EVERETT S. WALLIS, Princeton University

Grant No. 101 (1936). Development of methods for the laboratory preparation of estrus-producing hormones (female sex hormones).

WALLIS, EVERETT S., 1938. Report of Progress Yr. Bk. Amer. Philos. Soc. for 1937: 209-210.

— 1937 (with CHAKRAVORTY, P. N.). The Nature of the Sterols in Cottonseed Oil. Jour. Org. Chem. 2: 335-340.

— 1938. Studies in the Oxidation of the Trianhydrolactone of Onabain, and of *epi*-Neoergosterol. Jour. Amer. Chem. Soc. 60: 1379-1381.

ALEXANDER WEINSTEIN, Columbia University

Grant No. 211 (1938). A historical, biological, and philosophical study of human genetics.

This investigation deals with the history of genetics and evolutionism; with the data of human genetics; and with some philosophical aspects of these subjects.

The historical part consists of a study of original sources—writings, from the earliest times to the present, dealing with heredity and evolution. An analysis is made of the theories that have been proposed and the evidence on which they were based. Special attention has been devoted to knowledge and theories of human genetics.

The biological part examines critically the evidence on which rests the present-day knowledge of human heredity and of the influence of environment on human traits. Human evolution is considered in the light of this analysis as well as of recent evolutionary studies, both experimental and mathematical.

The philosophical part includes a logical analysis of the concepts of genetics and of some questions in the traditional field of philosophy on which genetics has a bearing.

WEINSTEIN, ALEXANDER, 1938. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1937: 227-228.

D. H. WENRICH, University of Pennsylvania

Grants No. 103 (1936) and No. 153 (1937). Continuation of a study of nuclear variations in the parasitic amoebae of man.

During the past year the study of nuclear division in intestinal amoebae was continued and experimental techniques were repeated and extended.

Previous results with techniques were largely corroborated. In addition the following points may be noted:

1. Although Schaudinn's fluid (2 parts of saturated aqueous solution HgCl_2 to 1 part ethyl alcohol; usually 5 per cent of glacial acetic acid is added) is generally recognized as the most satisfactory fixing agent for intestinal amoebae, it was found that the one-half strength solution recommended by Wenrich and Geimann (1933, Stain Technology, vol. 8) gave approximately as good results.

2. Use of the ingredients of Schaudinn's fluid separately were less satisfactory. When 25 per cent, 50 per cent, 75 per cent and 100 per cent of saturated aqueous solution of HgCl_2 were each used separately on *Endamoeba histolytica*, the weaker solutions gave more satisfactory fixations than the stronger. When 5 per cent, 10 per cent, 20 per cent and 50 per cent solutions of glacial acetic acid were each used alone, the endosome of *E. histolytica* failed to stain with haematoxylin after the first of these and the entire nucleus failed to stain after the intermediate and stronger solutions. After the 5 per cent solution the peripheral chromatin layer showed some stainability. When 50 per cent, 75 per cent, and 95 per cent alcohols were used separately, they gave approximately the same results, with the endosome staining prominently and the cytoplasm showing evidence of shrinkage and distortion.

3. Five per cent of a saturated solution of picric acid gave a better fixation than 25 per cent or 50 per cent of a saturated solution.

4. When various fixatives were employed at room temperature for various lengths of time from one minute to five hours, it was found that for the majority of the fixatives, one or a few minutes gave better results than the longer periods of time.

Study of the nuclear division in the vegetative stage of *Endamoeba muris* revealed a protracted series of prophase stages followed by a spindle organization which apparently includes two kinds of chromosome-like elements. Further study is needed to elucidate this situation.

WENRICH, D. H., 1937. Studies on *Iodamoeba bütschlii* (Protozoa) with Special Reference to Nuclear Structure. Proc. Amer. Philos. Soc. 77: 183-205.

— Studies on *Dientamoeba fragilis* (Protozoa). III. Binary Fission with Special Reference to Nuclear Division. Jour. Parasitology 25: 43-55.

— 1938. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1937: 178-180.

ANNA R. WHITING, University of Pennsylvania

Grant No. 133 (1937). A study of mutant body colors and of their multiple recessives in the parasitic wasp *Habrobracon juglandis* (Ashm.), reared at high and low temperatures and at different percentages of relative humidity; their behavior in mosaics.

Wild type individuals of the parasitic wasp *Habrobracon juglandis* vary from honey yellow to almost black. This is due primarily to culture temperature, higher producing more yellow, lower, more black. Heredity plays some part for different wild type races under constant temperature may differ consistently in pigmentation. Wild type males and those of the three body color mutant types, *black*, *honey* and *lemon*, as well as the four combinations of these, were reared under four conditions of temperature and humidity. These were A, 30° C., 33–39 per cent relative humidity; B, 30° C., 81 per cent; C, 19° C., 33 per cent and D, 19° C., 81 per cent. Wasps in A and B developed at the same rate and were alike in pigmentation and size, those in C and D were slower due to lower temperature. Those in C were slower than D, of the same color, but larger in size. Any lightening which the shorter cycle of D may have caused was cancelled by darkening due to smaller size.

It was found that more black pigment was produced at lower temperatures in all types except *honey*; that increase of black pigment due either to environmental or to genetic factors was accompanied by decrease in intensity of yellow. These facts were considered in light of Wright's theory of pigment formation in mammalian hair and it was found possible to interpret them on that basis.

Multiple recessives showed the combined deficiencies of the single mutant types. Thus *lemon* contributed its reduced black and yellow, *honey* its lack of black to the double recessive, *lemon honey*, which was a pale yellow with a faint sootiness on the thorax showing only at the lower temperature.

Mosaic sons occasionally appear among the progeny of females heterozygous for body color differences. The two nuclei differing in genetic makeup which enter into their formation may be the egg pronucleus and the second polar body. Among the first twenty-seven found were included eight of the twenty-eight combinations which might appear. The genetically different regions were strictly

autonomous with sharp lines of demarcation between the areas of different colors. Distribution of the two color areas varied from perfect right-left mosaics to a scattering of patches of one type on the other. Antero-posterior mosaics were also found. This variation in distribution is to be expected in view of the type of early embryonic development characteristic of insects.

Eighteen colored paintings of the body color types reared at high and low temperatures and of two mosaics have been made and are published in the PROCEEDINGS of the Society.

WHITING, ANNA R., 1938. Mutant Body Colors in *Habrobracon* and Their Mosaics. *Genetics* 23: 175.

—— 1939. Mutant Body Colors in the Parasitic Wasp *Habrobracon juglandis* (Ashm.) and their Behavior in Multiple Recessives and in Mosaics. *Proc. Amer. Philos. Soc.* 80: 65-85.

P. W. WHITING, University of Pennsylvania

Grants No. 11 (1934) and No. 48 (1935). Investigations on genetics and sex determination in the parasitic wasp *Habrobracon*.

(Abstract of paper read at General Meeting, November 19, 1938)

As viewed from the aspect of modern genetics, sex-determination in insects related to the honey bee has been very puzzling. The males come from unfertilized eggs and are therefore fatherless, receiving a single set of hereditary elements from the mother alone. Females developing from fertilized eggs have a double set, one from each parent. The ratio of sex-determining factors should be the same in the double set as in the single, so that it has not been clear what causes sex difference. The small parasitic wasp *Habrobracon*, a close relative to the honey bee and having the same peculiar type of reproduction with fatherless males, is easily and rapidly reared in the laboratory and its heredity has been intensively studied. It has been shown that certain abnormal sterile males resulting from inbreeding are not fatherless but develop from fertilized eggs. They have the double hereditary set. Why then are they males instead of females? The question has been answered by breeding experiments showing that there are two kinds of normal males, each with different sex-determining elements, X and Y. Females have a combination of the two different male sets, X + Y. The abnormal sterile males produced by inbreeding have either one or the other male set doubled, 2X or 2Y, and therefore have the same ratio of sex-determining elements as the normal males but the

female is necessarily different, being a combination $X + Y$, of the two normal types of males, X and Y . Inbreeding not only results in sterile males, but also in many unhatchable "bad" eggs. The problem as to why these bad eggs and sterile males do not occur in crossbreeding is now being studied.

WOMAN'S MEDICAL COLLEGE OF PENNSYLVANIA,
Esther M. Greisheimer

Grant No. 76 (1935, with FAY, M., HAPKESBRING, R., ANDERSCH, M., KENYON, M., MACCALMONT, W., CORTELL, R., INGLEBY, H., AND GEISS, M.). Study of the effects of various general and spinal anesthetics on the nervous system, circulatory system, etc. . . . to be followed by the pathological examination of such tissues as the liver, kidney, brain and heart.

Effects of Nembutal and Ether

After establishing controls of blood pressure, heart rate, kidney function, liver function, respiration, rectal temperature, hemoglobin, red, white and differential counts, three dogs were subjected to repeated anesthetic doses of nembutal. Twenty-two such experiments were performed. The most marked effect was on respiration; the rate often decreased to twenty-five per cent of its control value. The heart rate increased and the pulse pressure decreased. The effects of nembutal alone on the other reactions studied were not striking or constant.

In the next study, the same three dogs were used. Smaller doses of nembutal were given, followed within fifteen minutes by ether. Surgical anesthesia with ether was maintained for one hour.

With the combination of nembutal and ether, the respiration rate increased to almost twice its control value. The heart rate increased markedly. The pulse pressure usually decreased. The urea clearance, tested on the day following the anesthesia, increased. The blood picture changes were not striking.

ALBERT ELMER WOOD, Cape May Court House

Grant No. 112 (1936). Study of variation among the Cricetid rodents of the White River Oligocene.

The work on the problem of individual variation in White River Cricetids is making slow progress. A manuscript is nearly completed dealing with the dental variations of a small group of speci-

mens from exactly known horizons. The main types of dental variation have been differentiated, and progress is being made in correlating these types of variation with geographic and geologic source of the material. The studies are also being extended to include age variation in specimens with identical tooth patterns except for the effects of wear.

WOOD, ALBERT ELMER, 1938. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1937: 214-215.

HORACE ELMER WOOD, 2ND, University of Newark

Grant No. 2 (1933). Research and publications on the anatomy, stratigraphic distribution and phylogeny of the rhinoceroses and related groups of perissodactyls.

During the summer of 1938, the fossil rhinoceroses in the following collections were studied: University of California, California Institute of Technology and Agricultural and Mechanical College of Texas. This completes a survey of the important collections in North America, as well as most of the minor collections.

During the same trip, hitherto unvisited formations containing rhinoceroses were examined in Wyoming, California and Texas, essentially completing a survey of the relevant formations and principal localities in North America (except Florida, not yet seen).

WOOD, HORACE ELMER, 2ND, 1938. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1937: 124.

— 1938. Causal Factors in Shortening Tooth Series with Age. Jour. Dental Research 17: 1-13.

— 1938. "Orthogenesis" in Amynodont Rhinoceroses. Bull. Geol. Soc. Amer. 49: 1924.

— 1938. *Cooperia totadentata*, a Remarkable Rhinoceros from the Eocene of Mongolia. Amer. Mus. Novitates 1012: 1-20.

E. J. WORKMAN and R. E. HOLZER, University of New Mexico

Grants No. 140 (1937) and No. 233 (1938). Electrical measurements of the structure of thunderstorms.

The grant of the American Philosophical Society has made possible the completion of a research program begun in 1937. The surface electric field intensity was measured continuously at five stations near Albuquerque, New Mexico, during five thunderstorm periods in 1938, by means of specially designed recording, gen-

erating voltmeters. These electrical measurements were correlated with visual observations of stroke positions and meteorological data during day storms and with photographic data during night storms.

Analysis of three of the nine storms for which data were obtained have lead to the following preliminary results: (1) The quantity of charge transferred in a cloud-ground lightning stroke can be calculated by the field recorder method with an estimated accuracy of 30 per cent or less (depending on the complexity of the stroke). The quantities measured to date range from 15 to 200 coulombs. (2) The charge at the base of the cloud in the most active portion of a thunderstorm is negative as indicated by the sign of the charge change due to lightning strokes, the sign of the charge growth rate, and the sign of the field itself. (3) The portion of the base of the cloud immediately behind the most active region and occasionally at the sides of the active region is positive. Strokes within the cloud presumably from the active region, reduce the magnitude of the positive charge and occasionally cause reversal of sign. (4) The upper portions of the cloud over the most active region is positive as indicated by recorders at some distance from the storm and by frequent field reversals immediately after a stroke under the most active portion of the storm. (5) The existing theories of thunderstorm formation are either inadequate or incorrect. (6) A more complete analysis of storms by the field recorder method depends upon increasing the number of recorder stations and the amount of auxiliary meteorological data.

A preliminary report of the above results was presented at the Washington meeting of the American Physical Society on December 27, 1938, in papers No. 40 and No. 78. A complete report of the results will be submitted for publication in the spring of 1939.

WORKMAN, E. J., 1938 (with HOLZER, R. E.). Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1937: 232-235.

SUMMARY

The serial numbers of grants made in successive years and those for which no reports have been furnished for publication in the YEAR BOOKS for 1937 or 1938 may be summarized as follows:

Year	Grant Nos.	Reports lacking
1933-34	1-35	None
1935	36-83	Nos. 47, 78
1936	84-126	" 102, 108
1937	127-200	" 132, 159, 163, 166, 167, 171, 172, 181, 182, 192, 193, 196
1938	201-289	36 Reports in this volume

There has not been sufficient time for reports from these latest grants but these and some of the earlier ones will probably be represented in future numbers of the YEAR BOOK.

THE JOHNSON FUND

Two important additions to the research funds of the Society were made during the year 1937. The first of these is the Eldridge Reeves Johnson Fund of \$500,000.

In the campaign for a new building in 1929, Mr. Johnson contributed this amount for the proposed building on the Parkway. After it had been decided by the Society not to erect this new building but to remain in our old historic home and to devote the available funds of the Society to "the promotion of useful knowledge," the consent of Mr. Johnson and his family was sought to change the purpose of this gift from the building to the general purposes of the Society. This request was graciously granted as was verbally reported to the Society by President Morris on November 27, 1937.¹ The letter of Mr. E. R. Fenimore Johnson, Attorney, follows:

"Replying to your letter of May 24th, in which you advise Mr. Johnson that the Society does not wish to use Mr. Johnson's \$500,000 subscription for the purpose to which the gift was restricted, and requesting that the Society be permitted to use the gift for other purposes,—it will be entirely agreeable to Mr. Johnson for you to use all income from the gift for the general purposes of the Society.

"The gift of the principal to the Society is hereby confirmed and the restriction on the principal sum of the gift is hereby changed from Building and Endowment to simply Endowment until 1957, unless prior thereto Mr. Johnson directs that it be used for some other purpose of the Society. After 1957 it is to become an unrestricted gift."

In a supplementary letter Mr. Johnson wrote:

"As I told you, Father has shown an interest in the work of the Johnson Foundation for Research in Medical Physics at the University, the work of the University Museum, and of the Academy of Natural Sciences, and should it be the judgment of the Society that it is worth while to make grants to workers in those institutions, I am sure it would please him."

With this capital sum of \$500,000 which was withdrawn from the Building Fund there has been established the Eldridge Reeves Johnson Fund for the promotion of useful knowledge. In the distribution of the income of the Johnson Fund it was decided by the

¹ YEAR BOOK, Amer. Philos. Soc. 1937, p. 53.

Committee on Finance that workers in the three institutions named in Mr. Johnson's letter be considered as occupying a preferred position without, however, obligating the Society to restrict such distribution to workers in these institutions. By vote of the Council which was approved by the Society at its meeting on November 27, 1937, the distribution of the income of the Johnson Fund was assigned to the Committee on Research and this body was instructed to prepare a statement of the principles which would be followed in making grants from this fund and to draw up blank forms of application for grants and to receive and pass upon such applications. In general the principles and application forms in all our research funds are similar, and in the future it is proposed to use a single set of forms for all applications for grants.

The accumulated income of the Eldridge Reeves Johnson Fund at the close of the year 1937 amounted to a little more than \$21,000, and on February 11, 1938, the Committee on Research considered and approved the following applications for grants from the Johnson Fund amounting to \$20,850:

ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA

Grant No. 1—Geology and Paleontology Department, for assistance in the study of type and undescribed specimens of fossils in the Academy's collection in preparation for making of a published, annotated, and illustrated list of such specimens, including new material not heretofore described or illustrated...	3,580
Grant No. 2—Henry W. Fowler, for the publication of a report on the fishes obtained by the George Vanderbilt South Pacific Expedition of 1937, comprising over 25,000 specimens, new species, rare or little known forms, besides extensive items in distribution, variation, taxonomy, etc. Publication to be a number of the "Monograph" series of the Academy.	1,500
Grant No. 3—Samuel George Gordon, for travel expenses in making a mineralogical survey of the Atacama Desert, Chile.	920
Grant No. 4—Francis W. Pennell, for travel expenses, photography, etc., in making a study of the Scrophulariaceae of Western Temperate North America on a taxonomic, geographic, and phylogenetic basis.	500
Grant No. 5—H. Radclyffe Roberts, for field work and transportation in making a distributional and taxonomic study of the Orthoptera of Mexico and especially their relation to the Orthopteran fauna of the United States.	500

UNIVERSITY MUSEUM, UNIVERSITY OF PENNSYLVANIA

Grant No. 6—Alan Rowe, for printing and editorial work in the publication of his manuscript, "The Four Canaanite Temples	
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	of Beth Shan." This volume deals with the temples of Rameses II, Seti I and Amenophis III excavated by the Palestinian Expedition at Beth Shan.	2,500
Grant No. 7—	V. J. Fewkes, for printing and editorial work in the publication of his manuscript, "Excavations at Homolka," a final report of the completed investigation of an aneolithic fortified camp site in Czechoslovakia with an occupation period of several hundred years.	1,000
Grant No. 8—	H. U. Hall, for printing and editorial work in the publication of his manuscript entitled "Studies of the Sherbro Tribe, Sierra Leone," a report of the expedition to Sierra Leone, West Africa, conducted during 1936-37.	1,000
Grant No. 9—	Frederica de Laguna and Kaj Birket-Smith, for printing and editorial work in the publication of their manuscript entitled "Ethnology of the Eyak Indians of Alaska," covering ethnological material obtained by a joint expedition of the University Museum and the Danish National Museum in 1933.	1,200
Grant No. 10—	J. Alden Mason and Linton Satterthwaite, Jr., for architectural and editorial work in the completion of their manuscript and architectural drawings for their report entitled "Excavations at Piedras Negras," a final publication of seven years' work at the site of the ancient Maya city of Piedras Negras, Guatemala, including architectural studies of the temples and palaces which have been uncovered by the expedition as well as studies of the artistic and historical material found at the site.	1,300

ELDRIDGE REEVES JOHNSON FOUNDATION FOR MEDICAL PHYSICS, UNIVERSITY OF PENNSYLVANIA

Grant No. 11—	Leslie A. Chambers and J. B. Bateman, for material equipment and technical assistance in the study of the molecular organization of cell surfaces in relation to biological activity and specificity.	1,500
Grant No. 12—	Detlev W. Bronk, for material, equipment and assistance in the study of the mechanism of chemical excitation of nerve cells.	1,800
Grant No. 13—	Detlev W. Bronk, for material, equipment and assistance in making a general investigation of the nervous control of body organs in terms of the properties of nerve cells and fibers which make up the sympathetic and parasympathetic nervous systems; with special reference to the physico-chemical processes which occur within these systems.	2,050
Grant No. 14—	H. K. Hartline, for material and equipment in connection with the study of the photo-chemical and neural processes of vision.	1,500

REPORTS FROM RECIPIENTS OF GRANTS FROM THE
JOHNSON FUND

(ALPHABETICALLY ARRANGED)

ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA

Grant No. 1 (1938). Geology and Paleontology Department. Study of type and undescribed specimens of fossils in the Academy's collection in preparation for making of a published, annotated, and illustrated list of such specimens, including new material not heretofore described or illustrated.

Stipends to Dr. B. F. Howell, Dr. E. H. Colbert, Mr. W. T. Clarke and Miss Virginia Tomlin were paid from this grant. These four members of the Academy's staff have during the year, with the aid of Dr. E. B. Howard, Miss Anne Harbison, and workers paid from other funds,

(1) Cleaned, sorted and rearranged the Academy's extensive collection of fossil mollusks, which includes many types, so that they are now easily available for study and reference,

(2) Cleaned, sorted and rearranged the Academy's collection of fossil brachiopods so that they are now easily available for study and reference,

(3) Completed an alphabetical card catalogue of the invertebrate fossils in the Academy's collection, and begun cross catalogues which will be arranged synoptically, stratigraphically, and geographically, so that information on these fossils will be easily available to any specialist who needs it,

(4) Continued the preparation of the catalogue of the mammalian fossils owned by the Academy. This catalogue now consists of 11,272 cards and 266 typewritten pages,

(5) Carried on field work in the Tertiary bone-bed at Agate, Nebraska, from which a valuable collection of mammalian fossils was secured,

(6) Cooperated with various specialists who have consulted the Academy's paleontological collections during the year,

(7) Made a report to the Department of Mines and Resources of Canada on a collection of Cambrian fossils secured by Miss Harbison from British Columbia in the summer of 1937,

(8) Begun the study of the vertebrate fossils collected in Burma by the 1938 Asiatic Expedition for Early Man, which was partly financed by the American Philosophical Society.¹

¹ See p. 130.

(9) Aided in the preparation of the exhibits in the Academy's New Hall of Earth History,

(10) Cooperated with the Faculty of the School of Earth Sciences of the University of Pennsylvania in developing the teaching and research in that school,

(11) Assisted in the organization of the new Geological Society of Philadelphia,

(12) Cooperated with Princeton University and Mount Holyoke College in a broad program of research in the field of Cambrian paleontology and stratigraphy which is being partly financed by the National Research Council and the Geological Society of America,

(13) Answered questions from the public and otherwise carried on the routine duties which fall to curators in such an institution as the Academy.

The progress made during the past year in rearranging and cataloguing its fossils will go far toward enabling the Academy to make available to its own staff and to visiting specialists the large and scientifically important collections of extinct invertebrates and vertebrates which have for so many years been practically inaccessible to scientists.

Once a leader in the field of paleontological research, the Academy has for a generation past been unable to carry on work in that science, or even to keep its collection of fossils in such condition that they could be studied. Now, thanks to the aid afforded by the American Philosophical Society, the Academy can once more do its share in promoting the study of the past history of life and thus help to make Philadelphia again, as it was formerly, a center for research and teaching in the earth sciences.

ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA,
Henry W. Fowler

Grant No. 2 (1938). Publication of a report on the fishes obtained by the George Vanderbilt South Pacific Expedition of 1937, comprising over 25,000 specimens, new species, rare or little known forms, besides extensive items on distribution, variation, taxonomy, etc.

FOWLER, HENRY W., 1938. The Fishes of the George Vanderbilt South Pacific Expedition. Monographs, Acad. Nat. Sci. Phila. 2: 1-349, 31 figs. and 12 pls.

ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA,
Samuel G. Gordon

Grant No. 3 (1938). Mineralogical Survey of the Atacama Desert of Chile, South America.

The Atacama Desert of Northern Chile—about the size of five New Jerseys end to end—is one of the most extensively mineralized areas in the world. From the volcanos that rim it on the east to the cliffs that tower above the Pacific shore, many mines have been opened from prehistoric time to the present. A study of maps in the Academy's Library indicated that it might be feasible to make a survey of these mineral areas by means of a motorcycle. A two-cylinder, three-wheel vehicle was obtained and taken by Mr. Gordon to Antofagasta, Chile, on the Santa Maria which left New York September 9. The vehicle was used in the desert between Cerro Pintados on the north to below Copiapó on the south, and from the Pacific Coast almost to the Bolivian border.

Hundreds of mines and prospects were visited, and 26 boxes of mineral specimens were collected for study in the mineralogical research laboratory of the Academy. Mr. Gordon returned on the Santa Clara which arrived in New York on January 3.

ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA,
Francis W. Pennell

Grant No. 4 (1938). A study of the Scrophulariaceae of Western Temperate North America on a taxonomic, geographic, and phylogenetic basis.

From May 6 to August 31, 1938, I was engaged in field study of the Scrophulariaceae of western North America, working especially in the states of Utah, Nevada, Colorado, Montana and Wyoming. The route was planned so as to supplement previous field studies in 1915, 1931 and 1937, the whole building toward a study of the western members of this family on the manner of my "Scrophulariaceae of Eastern Temperate North America," issued as a monograph of this Academy in 1935.

As in 1937, travel was by automobile and Mrs. Pennell's presence again made possible the greatest economy in camping. The addition to our party of Mr. Robert L. Schaeffer, Jr., enabled us to collect the flora rather fully, in addition to making the desired

studies of Scrophulariaceae. Of the 3383 collections made, 755 were Scrophulariaceae. Careful field descriptions and other notes were made of nearly 200 species of this family.

The main areas visited were the San Juan valley of northwestern New Mexico and southwestern Colorado; Grand Canyon and Kaibab Plateau of northern Arizona; from the Kanab country to the Pine Valley and Beaverdam Mountains of southwestern Utah; upper Colorado River valley from Grand Junction to the foot of the Rocky Mountains in Routt County, Colorado; Wasatch Mountains from the Duchesne Valley to Delano Peak, Utah; Duck Creek valley and Mt. Wheeler, Nevada; Ruby Mts. and Deeth, Nevada; Anaconda Range, Montana; Beartooth Mts., Montana and Wyoming; Teton Mts., Wyoming; and Bighorn Mts., Wyoming. Even the most known of these areas may have overlooked species, as is shown by a remarkable new *Penstemon* from Routt County, Colorado, and a new *Pedicularis* from the Teton Mountains.

Since September the preparation of the specimens for study has proceeded by the printing of labels bearing geographical data, and by the typing of ecological data thereon. Mr. Schaeffer has assumed the burden of organizing the material into systematic sequence, and of identifying specimens other than Scrophulariaceae. None of these tasks are yet completed, and hence the detailed study of the Scrophulariaceae obtained is not possible as yet.

PENNELL, FRANCIS W. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1937: 131-132.

ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA,
H. Radclyffe Roberts

Grant No. 5 (1938). A distributional and taxonomic study of the Orthoptera of Mexico and especially their relation to the Orthopteran fauna of the United States.

The Work of the Third Mexican Orthoptera Expedition

The purpose of this expedition was to obtain additional Orthoptera from some of the many regions of Mexico that are virtually unknown. Two previous trips have been made and some six thousand Orthoptera were then collected. From the previous col-

lection it was very evident that our knowledge of the fauna of Mexico was very meager and also very important in its bearing on the fauna of the United States. Since any report of a taxonomic nature would demand a rather complete revision of each group studied, it appeared very desirable to obtain at least representative species from large general areas that have not been previously investigated. The pursuance of this work was largely made possible by the grant-in-aid from the Eldridge Reeves Johnson Fund of the American Philosophical Society.

The trip was made by car with a camping outfit and some six thousand miles were covered on roads in Mexico not including a trip by train to Oaxaca. Two months and a half were spent in the country from July third to September nineteenth. The areas from which the most valuable collections were made were: Torreon and northeastern part of the state of Durango; Galeana, Nuevo Leon and La Maroma, Tamaulipas, both in the Eastern Sierra Madre; Northeastern Hidalgo; Oaxaca; along the new highway between Mexico City and Guadalajara (over four hundred miles of mountainous country). It was planned to carry out more extensive work in Durango and Chihuahua but the roads were practically impassable to the north and south of Torreon. After several attempts and being stuck in one place for three days by heavy rains in desert country in attempting to go north to Chihuahua we decided that the plan was not feasible at this time.

Approximately four thousand specimens were obtained from some sixty different localities. The Academy of Natural Sciences is now in possession of the entire collection and at present it is in the hands of the preparator being mounted and labeled. It will not be ready for study until about February or March. As mentioned above, it is planned to report on this and the previous collections in a series of revisionary studies. Considerable work has been carried out on the previous collections and it is already obvious that the new material will add greatly to the final conclusions. The number of new species and genera in some groups are as high as twenty per cent and will thus demand a large amount of routine descriptive work, but it is hoped to publish at least a portion of the results within a year.

UNIVERSITY MUSEUM, UNIVERSITY OF PENNSYLVANIA,
Alan Rowe

Grant No. 6 (1938). Publication of "The Four Canaanite Temples of Beth Shan." This volume deals with the temples of Rameses II, Seti I, and Amenophis III excavated by the Palestinian Expedition at Beth Shan.

This book "The Four Canaanite Temples of Beth Shan" is now in proof form and has been sent for correction to the author, Alan Rowe, who is now in Palestine. Plates and drawings including five folded plans in color have been made. It is expected that if the proofs are returned reasonably soon the publication date will be May 1, 1939.

UNIVERSITY MUSEUM, UNIVERSITY OF PENNSYLVANIA,
V. J. Fewkes

Grant No. 7 (1938). Publication of "Excavations at Homolka," a final report of the completed investigation of an aneolithic fortified camp site in Czechoslovakia with an occupation period of several hundred years.

UNIVERSITY MUSEUM, UNIVERSITY OF PENNSYLVANIA,
H. U. Hall ¹

Grant No. 8 (1938). Publication of "Studies of the Sherbro Tribe, Sierra Leone," a report of the expedition to Sierra Leone, West Africa conducted during 1936-1937.

HALL, H. U., 1938. The Sherbro of Sierra Leone. Univ. Mus., Univ. Pa. 51 pp., 60 figs., 18 pls., 1 map.

UNIVERSITY MUSEUM, UNIVERSITY OF PENNSYLVANIA,
Frederica de Laguna and Kaj Birket-Smith

Grant No. 9 (1938). Publication of "Ethnology of the Eyak Indians of Alaska," covering ethnological material obtained by a joint expedition of the University Museum and the Danish National Museum in 1933.

BIRKET-SMITH, KAJ, 1938 (with DE LAGUNA, FREDERICA). The Eyak Indians of the Copper River Delta, Alaska. D. Kgl. Danske Vidensk. Selsk. 592 pp., 18 pls.

¹ Research work supported by Grant No. 71 from the Penrose Fund.

UNIVERSITY MUSEUM, UNIVERSITY OF PENNSYLVANIA,
J. Alden Mason and Linton Satterthwaite, Jr.

Grant No. 10 (1938). Architectural and editorial work in the completion of the manuscript and architectural drawings for their report entitled "Excavations at Piedras Negras," a final publication of seven years' work at the site of the ancient Maya city of Piedras Negras, Guatemala, including architectural studies of the temples and palaces which have been uncovered by the expedition as well as studies of the artistic and historical material found at the site.

Preparation for Publication of Results of the Piedras Negras
Expedition ¹

1. *Factual Report of Findings.* a. Restoration drawings of twenty-six buildings, many involving several sequent stages, have been prepared. These include plans, sections and elevations, interior and exterior, sufficient for actual reconstruction of the buildings to the extent justified by their remains. Similar drawings were made for five temple pyramids, and nine temple building platforms. Integrated plans and cross-sections of Courts 1 and 2 of the Acropolis have been made, as well as isometric projections of most of the temple and palace buildings and building platforms. The descriptive text on architecture is in the form of notes only; it has been decided to await certain check-ups during the next season. For the same reason the drawings have not been inked.

b. The potsherds from the main Acropolis cross-section have been analyzed as to shape and decoration, four plates prepared and descriptive text written.

c. Certain especially important objects have been drawn.

2. *Interpretation.* a. Two ball-court types have been identified, relatively dated, and their distributions traced; the probable meaning of sculptured figures at Piedras Negras has been elucidated by a study of ball-court sculptures throughout the Maya Old Empire (text and plates ready for publication).

b. Roof-types on temples and palaces have been analyzed and relatively dated (text, in two sections, needs revision).

c. Stylistic and functional influences on Piedras Negras architecture, emanating from the center of the Old Empire (Peten) have been further analyzed (old manuscript needs revision).

¹ Research supported by Grants No. 151 and No. 285 from the Penrose Fund, see p. 236.

d. The subject-matter on the Piedras Negras monuments has been analyzed, and certain conclusions reached respecting the ancient ceremonies and the uses of palaces and temples (notes only).

e. The inscriptions and representations on the four stelae at the Museum have been exhaustively photographed with various lightings. Many details, previously unnoticed, or at least unrecorded, are ready for publication.

f. An analysis of bench types in the Piedras Negras palaces, combined with a study of the monuments, has been made the basis for conclusions respecting the true functions of palaces; the study has been extended to include the whole of Middle America, but is incomplete except at Piedras Negras (notes only).

g. The pottery analysis referred to under 1-b has justified the setting up of two sequent pottery periods and a beginning has been made at fitting the sequence into the general Middle American ceramic picture.

ELDRIDGE REEVES JOHNSON FOUNDATION FOR MEDICAL PHYSICS,
UNIVERSITY OF PENNSYLVANIA,

Leslie A. Chambers and J. B. Bateman

Grant No. 11 (1938). Study of the molecular organization of cell surfaces in relation to biological activity and specificity.

Our work has been done along two convergent lines: we have endeavoured on the one hand to study empirically the serological behaviour of antigenic materials extracted from bacteria and then deposited upon conditioned glass plates in the form of monolayers, and on the other, to approach the same fundamental problem of the nature and specificity of the cell surface from a physicochemical angle.

Since monofilms of protein are known to be structurally oriented, one may expect a localization of reactivity when the reactions depend upon particular polar or non-polar groups. A specially favorable material for demonstration of such localized specificity has been the agglutininogen (nucleoprotein) liberated from haemolytic streptococci by Chambers and Flosdorf and studied in some detail by Mudd and his co-workers. This material behaves type-specifically when in situ at the bacterial surface but gives group specific reactions in precipitation tests, from which facts one may conclude

that the specificity of the organism itself is conditioned by the geometrical configuration of its surface components.

We have transferred compressed monofilms of this streptococcal agglutininogen to glass slides. By suitable conditioning of the glass surfaces, slides were prepared having hydrophobic and hydrophilic faces respectively exposed. The preparations were then placed in an agglutination mixture (organisms + antibody), removed after an appropriate time, washed carefully, and stained. Subsequent counts of the bacterial cells adhering should be an index of the degree of specific antibody sensitization of a given oriented film preparation.

When a system homologous with respect to organisms and agglutininogen was used a marked difference in specificity of the two film faces toward antisera was apparent. In systems heterologous with respect to organisms and antigen the picture is less clear and will require further resolution.

We have found that a complement fixation technique is applicable to the deposited monofilms. Complement fixation is a far more reliable and precise method than agglutination since all the variables introduced by living organisms are eliminated.

These experiments show that a certain biological specificity can be correlated with a definite molecular orientation. This provides a new approach to the study of the antibody-antigen reaction.

The major problem in the physicochemical approach referred to above is to determine to what extent the properties of monomolecular films resemble those of the surfaces existing in biological systems. A necessary preliminary measure is to find means of studying the mechanical and electrical properties of the films in such a way that specific differences between different substances can be clearly demonstrated. For this purpose the conventional "limiting area," which has been of great value in studies on simple materials, is of little use, and we have found that the "surface elasticity," — $A \cdot dF/dA$ —, is a more convenient quantity to use. We have completed a study of films of egg albumin from this point of view, using for the measurements a surface balance designed and built under this grant, and have been able to show certain regularities in the behavior of these films as a function of pH which have not hitherto been apparent from studies of limiting areas. As a corollary we have been able to show that the mechanical properties of a film spread at the isoelectric point, where the "spreading

tendency" is high, is only slightly modified when the pH of the substrate is changed to a value at which the spreading tendency is reduced to less than one-tenth of its value at the isoelectric point. Thus the spreading tendency, which is the quantity usually determined in studies of protein films, is unrelated to the actual properties of the film when spread.

We propose to follow this study on egg albumin with an examination of other complex substances and their specific differences from the same standpoint, giving particular attention to the phosphoproteins and nucleic acids, among them the sonic-extracted bacterial antigens referred to above, and to other complex proteins, lipo-proteins, lipins, specific carbohydrates, and so forth, that may be presumed to be of importance in the architecture and function of living cells. These studies will be accompanied by electrical examination of the films by

- (1) Determination of surface potentials of films on liquid substrates,
- (2) Determination of the contact potentials between various solutions and the surfaces of deposited protein monolayers,
- (3) Determination of streaming potentials for hydrophilic and hydrophobic monolayers of proteins, and their variation with the ionic composition of the streaming fluid. The apparatus for this work will shortly be ready for use.

These studies should have notable bearing upon the problem of specificity and also upon the nature of bioelectric phenomena.

Certain other questions have arisen in our work on egg albumin films which have suggested a more detailed examination of the elastic properties of the films. We have made a number of observations on the onset of rigidity in monolayers as the area is decreased by compression, by studying the ability of the films to pass through a slit 5 mm. in width, and have noted variations which are not accompanied by any changes in the force-area curves. For a more precise study we have constructed a second surface balance which will enable us to measure simultaneously the forces exerted in the direction of compression and in the direction at right angles to it. From this measurement we hope to be able to calculate the 2-dimensional bulk modulus and the modulus of rigidity of the film, and to determine over what range of surface pressures the films are isotropic. Rigidities and, in the case of non-rigid films, viscosities,

will also be determined by observing the behaviour of a circular disc lying in the surface, to which a torque is applied.

ELDRIDGE REEVES JOHNSON FOUNDATION FOR MEDICAL PHYSICS,
UNIVERSITY OF PENNSYLVANIA,
Detlev W. Bronk

Grant No. 12 (1938). Study of the mechanism of chemical excitation of nerve cells.

The structural and functional characteristics of the cells of the nervous system are significantly modified by alterations in their chemical environment. We are therefore studying the stimulating effects of various chemical agents in order that we may obtain a clearer understanding of the basic molecular structure of nerve and its relation to the processes of excitation and conduction; and in order that we may determine the significance of those chemical changes in the environment which are known to occur in normal and pathological states of an organism.

We have developed a technique for isolating single nerve fibres which are then immersed in fluids of controlled chemical composition. The functional state of the fiber is determined by measuring the electrical properties of the treated region and by recording, as a measure of its activity, the impulses which are developed.

Because of the importance of calcium as a component of living cells we have given particular consideration to the effects of alterations in its concentration inside and outside a nerve fiber. When this is decreased by bathing the nerve in calcium-free solutions or in solutions of citrate the altered region of the nerve initiates a sequence of impulses which follow one another in a definite rhythm. We find that this frequency is determined by the rate of removal of the calcium. How the initiation of these impulses is related to the local changes of electric potential which result from the redistribution of ions is now being investigated. Under certain conditions the continuous train of impulses ceases for a time and starts again, at regular intervals, thus indicating the existence of two rhythmic processes in the activity of the nerve. Under these circumstances the peripheral nerve fiber behaves in a manner closely resembling a motor nerve cell in the respiratory center which discharges trains of periodically recurring impulses in each periodically recurring respiratory cycle. We have observed many other

characteristics of the activity induced in nerve fibers by alterations of their chemical composition which show that the fibers possess most of the functional characteristics of more highly organized sense organs and motor nerve cells.

Another method which we have devised for the investigation of this problem consists in the perfusion of a sympathetic ganglion with various chemical solutions while recording the nerve impulses thus initiated. In this way it has been possible to alter the chemical environment of nerve fibers running through the ganglion and of the cell bodies of those neurons which originate within the ganglion. Our preliminary experiments indicate that the response of fibers and of cells to various chemical agents is in many respects the same. It is of especial interest to find that lack of oxygen blocks conduction in the fibers when it abolishes the excitability of the cells. This is contrary to a prevalent view that nerve fibers are much more resistant to oxygen lack than are cells and synapses.

This procedure for modifying the chemical environment of ganglion cells has provided us with an effective method for a study of the transmission of nervous activity from one neuron to another at a synapse. The most generally accepted theory of this mechanism assumes that the transmission is by the liberation of a specific substance from the presynaptic terminations. In order to evaluate this theory we are studying the stimulating and depressing action of chemical substances on the ganglion cells and are determining what is their effect upon the synaptic transmission of impulses. For instance, we find that either an increase or a decrease of calcium ions blocks the synaptic pathway at a time when direct fiber transmission is unaffected. This suggests that calcium ions are of particular significance in synaptic mechanisms. On the other hand we find no such specific effect of potassium or chloride ions. We are now investigating the role of these various ionic changes in the formation and excitatory action of acetylcholine.

Inasmuch as this chemically induced activity is due to alterations in structure it would be desirable to determine what are the structural characteristics during the various phases of activity. Histological observations have thus far revealed little, but an electron microscope is now being constructed and with this we hope to follow possible changes in the location and concentration of the various ions.

ELDRIDGE REEVES JOHNSON FOUNDATION FOR MEDICAL PHYSICS,
UNIVERSITY OF PENNSYLVANIA,
Detlev W. Bronk

Grant No. 13 (1938). A general investigation of the nervous control of body organs in terms of the properties of nerve cells and fibres which make up the sympathetic and parasympathetic nervous systems; with special reference to the physico-chemical processes which occur within these systems.

One of the most important factors in the nervous organization of biological activity is the capacity of one nerve cell to excite other nerve cells at their synapses. The properties of these junctions determine what pathways and what groups of cells in the central nervous system are active at any instant, and it is these fluctuating patterns of activity which determine the behavior of the organism. Our work during the first six months of this grant has been concerned primarily with the study of the transmission of nerve impulses across the synapses of a sympathetic ganglion.

The basic procedure of the experiment is to send impulses into the ganglion over preganglionic nerve fibers. At the terminations of these fibers the impulses act directly upon those cells whose fibers run out in the postganglionic nerve trunk. If the cells in the ganglion are excited, they discharge impulses over their fibers, and the action-potentials of these impulses are recorded with suitable electric devices. Those impulses provide then a measure of the activity of the ganglion cell, and we have therefore a means for investigating what is the effect of nerve impulses at a synapse. We have recently improved our previous technique by developing a method for recording the activity of individual nerve cells.

It is widely believed that each volley of impulses arriving at a synapse develops an excitatory state of the adjoining cell body and its environment which decays so rapidly that only one impulse is discharged from the cell. Some account for this by assuming that excitation is caused by the brief electrical current of activity in presynaptic fibers; others believe that this transient excitation is accomplished when the presynaptic impulse liberates a small charge of acetylcholine which is then very rapidly hydrolyzed. We have, during the past few months, found that a train of impulses may develop an excitatory state which persists for fifteen or more seconds after the end of the incoming impulses. This excitatory state

is revealed by the continued discharge of impulses from the pre-synaptic cells; the gradual decrease in the excitatory state is indicated by a gradual decline in the rate of discharge of impulses. The discovery of this persistent state of excitation requires the modification of present theories of synaptic transmission.

We have also discovered a closely related finding which indicates that a train of impulses arriving at a synapse leaves the adjoining cells in a state of increased excitability for some time. The experimental observation is that a volley containing a certain number of preganglionic impulses excites a definite number of ganglion cells to discharge. After repeated excitation in this way we find that the number of ganglion cells responding to a given volley of impulses is increased by a factor of four or five, and this state of increased responsiveness lasts for a minute or more.

These two sets of experiments show that the messages of the nervous system produce in the synaptic regions of the sympathetic ganglia altered conditions which have long-lasting effects on the properties of the synapse. If these phenomena are found also to be characteristic of synapses in the central nervous system, it will be necessary to alter many of our concepts concerning the organization of nervous activity.

It has been shown by Gasser and his associates that, following the transmission of one or more impulses, the previously active nerve shows a cycle of slow changes in electrical potential. These after-potentials correspond to altered functional states of the nerve. Thus, during the phase of the positive after-potential a nerve is less easily excited by an electrical stimulus. The after-potentials are therefore useful signs of the irritability of the nerve. Because the natural excitation of cells in the nervous system at synapses may be by chemical agents it is important to know whether there is a correlation between the after-potentials of a group of nerve cells and their excitability by those chemical agents. We have therefore stimulated nerve cells in a sympathetic ganglion by passing through the circulation adequate concentrations of acetylcholine or potassium. While the cells were discharging impulses during such a period of chemical excitation the ganglion cells were further excited by a short train of preganglionic impulses. In this way they were caused to develop a large positive after-potential. During the course of this after-potential there was a decreased response of the cells to the exciting chemical, with a close parallelism between the

magnitude of the after-potential and the degree of excitability. It is therefore established that the after-potentials indicate the irritability of nerve cells for chemical excitation as they do for electrical, and these potentials therefore become useful for interpreting the activity of the central nervous system.

ELDRIDGE REEVES JOHNSON FOUNDATION FOR MEDICAL PHYSICS,
UNIVERSITY OF PENNSYLVANIA,
H. K. Hartline

Grant No. 14 (1938). Study of the photo-chemical and neural processes of vision.

Two series of investigations are being carried on under the present grant. The object of the first phase of the work is to learn more about the mechanisms whereby visual sense cells are stimulated by light, and how they generate nerve impulses in their axons. From the coarsely faceted compound eye of *Limulus* it has been found possible to isolate a single ommatidium, containing 10-12 visual sense cells, together with about 0.2 mm. of attached nerve fibers. Upon illumination of the facet the sense cells produce a discharge of impulses in their respective axons, which may be recorded by means of the amplified action potentials of the nerve bundle. Coincident with the appearance of nerve activity there is a change in the electric potential difference measured across the group of sense cells (retinal action potential). This is a slow, smoothly changing response which is quite different from the rapid, spike-like action potentials in the nerve; it is found to be a separate process, not merely the result of summed nerve impulses. It is an attractive hypothesis to assume that the retinal action potential, with its associated local circulating currents, is the direct means whereby a sense cell stimulates its axon. And the discharge of impulses in a single fiber does indeed follow the rise and fall of retinal action potential in a general way. However, quantitative evidence for the support of this hypothesis is still lacking. In order to clarify this problem apparatus is being developed, under the provisions of this grant, which will provide accurately timed flashes of light for stimulation, and which will make possible simultaneous recording of both nerve and retinal action potentials from the same preparation.

The second series of investigations is a continuation of studies

of the discharge of impulses in single optic nerve fibers from the vertebrate retina. In the vertebrate eye the optic nerve fibers are the axons of the retinal ganglion cells, and the retinal structures intervening between them and the visual sense cells (rods and cones) complicate the optic responses. The present research is concerned with the spatial factors in the excitation of single optic nerve fibers; problems which underly the mechanisms of visual acuity and pattern vision. I have previously shown that a given optic nerve fiber can be stimulated by illumination falling anywhere within a particular region of the retina several square millimeters in area. Thus the excitation from many visual sense cells converges upon a single ganglion cell. I have furthermore shown that within the region of the retina supplying a given optic nerve fiber the effects of convergence are greatest over a small central portion, about $\frac{1}{4}$ mm. in diameter, and fall off gradually to zero with increasing distance from this center. The present investigations have established the fact that activity reaching the ganglion cell from different portions of its region of convergence is additive in the excitation produced in the optic nerve fiber. Moreover, this summation is greatest in the central portion of the region, where the convergence is most effective.

Certain of the optic nerve fibers in the vertebrate retina respond only to cessation of illumination. These "off" responses, I have previously shown, are abruptly inhibited by re-illumination of the spot which is used to elicit them. I have now demonstrated that they are also inhibited by illumination of an adjacent spot on the retina, provided this falls within the region of convergence for the particular fiber under observation. Thus inhibitory as well as excitatory influences converge upon the ganglion cells. Experiments on the time course of the rise and fall of inhibitory influences indicate that the "off" responses arise not in the layer of rods and cones, but in the ganglionic layers of the retina. The evidence on this point, however, is not conclusive. This and related questions will be investigated with improved apparatus which is being developed in order to provide more accurate patterns of retinal illumination.

THE DALAND FUND

By the will of the late Dr. Judson Daland, the American Philosophical Society was made his residuary legatee for the purpose of establishing an endowment fund to be known as the Judson Daland Foundation for Research in Clinical Medicine, the income only, less 10 per cent which is to be added to the principal annually, to be used by the Society for research in clinical medicine. While leaving the Society free in the use of the income of this fund for the purpose indicated, in a supplementary letter Dr. Daland expressed his desire that the work of the Philadelphia Institute for Medical Research, of which he was President, should receive the income from this bequest, provided that at all times the Institute in the opinion of the American Philosophical Society's Committee on Research merits such income and can carry on useful work thereby.

The capital sum realized from this estate after all expenses had been paid was about \$220,000. In response to an application from the Philadelphia Institute for Medical Research received during the summer of 1938, a grant of \$3,000 from accumulated income was authorized, and the Institute was advised that approximately \$6,000 would be available for grants during 1939.

Drs. A. Newton Richards and Edwin G. Conklin were appointed a sub-committee of the Committee on Research to consider and report upon applications for grants from the Daland Fund.

6. REPORT OF THE COMMITTEE ON FINANCE

According to the Laws of the Society, the Committee on Finance consists of the President and the Treasurer, *ex-officio*, and not fewer than five other members who shall be nominated by the President and elected by the Society at the General Meeting in April.

Chapter V, Articles 3 and 4 of the Laws read:

"The Committee on Finance shall have the general superintendence of the financial concerns of the Society. It shall have the custody and control of all the securities and investments of the Society, both real and personal, with full power and authority to buy and to sell, and to invest and reinvest the same; including the power to purchase and to sell real estate and to make leases thereof, to satisfy mortgages and extinguish ground rents, and to direct the placing of all such insurances as it may deem necessary; as well as to borrow on the credit of the assets of the Society, to create mortgages thereon, and to make such improvements, repairs and alterations to real estate as it may deem necessary. It shall have power to authorize the proper Officers of the Society to execute the necessary papers to effect all purchases, sales and assignments of property, both real and personal; to execute and to satisfy mortgages, to extinguish ground rents and to transfer registered securities; to subscribe to bond-holders' agreements to plans of reorganization involving any securities held by the Society or in which it has an interest, and to do all such acts as are necessary in pursuance of the foregoing powers.

"The Committee on Finance shall always have access to the Treasurer's books, accounts, and vouchers, and shall cause an audit of such accounts to be made at least once a year. It shall require from the Treasurer an annual report of all the operations of the treasury, which it shall present to the Council with an annual statement of estimates of receipts and expenditures. With the approval of the Council it shall determine the fiscal year of the Society and, in case of emergency needs, authorize appropriations over and above the annual budget."

During the year 1938 the Committee on Finance consisted of William P. Gest,† *Chairman*, Thomas S. Gates, John S. Jenks,

† Deceased January 12, 1939.

Marshall S. Morgan, George W. Norris, Charles J. Rhoads, J. Henry Scattergood, and Roland S. Morris, *President*. Edwin G. Conklin, *Executive Officer*, and Morris Duane, *Legal Consultant*, sat with the Committee.

The members of the Committee met regularly once a month from January to June and from October to December with occasional special meetings.

REPORT OF THE TREASURER

GENERAL AND SPECIAL FUNDS

There are twenty-two funds in the keeping of the Society. Only four of these are unrestricted in the uses to which their income may be applied "for promoting useful knowledge;" three specify a primary purpose, after which any balance may be used for general purposes; fifteen are restricted to specific uses, eleven of these being for the purchase of books for the Library. These funds and the manner and purpose of their establishment are listed alphabetically as follows:

BALCH INTERNATIONAL LAW LIBRARY FUND

Founded by Thomas Willing Balch, Esq., of Philadelphia, October 13, 1911, with an initial gift of securities valued at about \$700, increased by later gifts to about \$1,600, as a memorial to his father for his part in bringing about the submission of the Alabama Claims to the Geneva Tribunal. A part of the income to be used for the purchase of books relating to the law of nations and such other uses, when thought advisable, as may promote the study of that science; a part, not less than one-half, to be added annually to the principal.

BOYÉ LIBRARY FUND

Bequest of \$1,879.21 by Professor Martin Boyé, of Coopersburg, Pa., who died March 5, 1909. By resolution of the Society, December, 1910 the income to be expended in the purchase of books, preferably on chemistry and geology.

BRUSH ENDOWMENT FUND

Gift of \$10,000 by Charles Francis Brush, LL.D., of Cleveland, Ohio, November 24, 1914. Income to be used for the general purposes of the Society.

BUILDING FUND

Created by deed of trust dated June 4, 1900, Girard Trust Company, depositary and trustee. All money or property which shall be designated or devoted by any donor, testator or other person, for the acquisition of land or buildings for the Society's use, shall be forthwith paid over, conveyed, or delivered by the Society to the said depositary, for the acquisition of land and the construction and furnishing of buildings for the use and occupation of the Society. The present value is \$605,920.73.

CARLIER LIBRARY FUND

Bequest of \$5,000 by Auguste Carlier, of Paris, who died March 16, 1890. The income, less 10 per cent which is to be added to the principal, to be expended for the purchase of books for the Library.

CARNEGIE LIBRARY FUND

Gift of \$100,000 by the Carnegie Corporation in 1931. The income to be used for the maintenance of the Library.

DALAND FUND

Bequest of the residuary estate of Dr. Judson Daland, of Philadelphia, who died August 14, 1937, approximately \$220,000. The income, less 10 per cent which is to be added annually to the principal, to be used by the Society for research in clinical medicine.

ENTERTAINMENT FUND

Contributions of approximately \$4,250, by various donors since 1906. The income to be used to defray the cost of entertainment. This Fund has been consolidated with the General Fund as of December 31, 1938.

FRANKLIN LIBRARY FUND

Established by the Library Committee in May, 1911, from funds derived from the proceeds of the sale in that year of duplicates, formerly the property of Benjamin Franklin, approximately \$3,400. The income to be used for the purchase of books.

GENERAL FUND

This fund has been accumulated from various sources through many years; its income is available for the general purposes of the Society.

JEFFERSON LIBRARY FUND

Established by the Library Committee on January 20, 1905, from the proceeds of royalties from the publication of manuscripts acquired by the Society through President Thomas Jefferson, approximately \$1,700. Income to be used for the purchase of books.

JOHNSON FUND

Established in 1937 when Mr. Eldridge Reeves Johnson removed the restriction on his gift of \$500,000 and changed it from the Building and Endowment Fund to simply Endowment until 1957, unless prior thereto Mr. Johnson directs that it be used for some other purpose of the Society. After 1957 it is to become an unrestricted gift. All income to be used for the general purposes of the Society.

LEWIS FUND

Gift of \$10,000 made by Mrs. John F. Lewis in 1935 in memory of her husband; the income to be used each year as an award to the American citizen who shall announce at any general or special meeting of the Society, and publish among its papers, some truth which the Council of the Society shall deem worthy of the award. In any year income not so awarded to be added to principal.

MAGELLANIC FUND

Gift of 200 guineas by John Hyacinth de Magellan, of London, in 1786, for a gold medal to be annually awarded under prescribed terms, to the author of the best discovery or most useful invention relating to navigation, astronomy, or natural philosophy (mere natural history only excepted). Any surplus of interest remaining to be used for such purposes as may be authorized under the Society's Charter and Laws. By resolution of the Society, December, 1899, the unexpended annual income, less 10 per cent, which is to be added to the principal, may be used for the purchase of books relating to those departments of science in which the premium is annually offered.

MICHAUX FUND

Bequest of 92,600 francs by François André Michaux, who died at Paris, October 23, 1855; for the extension and progress of agriculture, and more especially of silviculture, in the United States. By resolution of the Society, March, 1899, the income, less 10 per cent reserved for reinvestment, to be used for the purchase of books on forestry, etc.

NORRIS LIBRARY FUND

Established by the Library Committee in May, 1911, from the proceeds of the sale in that year of duplicate pamphlets, presented to the Society in 1815 by Joseph Parker Norris, Esq., of Philadelphia, approximately \$2,100. Income to be used for the purchase of books.

PHILLIPS LIBRARY FUND

Bequest of his residuary estate, approximately \$3,410 (December 1895) by Henry Phillips, Jr., Esq., of Philadelphia, who died June 6, 1895, to which were later added two bequests to him, confirmed and audited October 5, 1903, of \$7,547.54 from the estate of his aunt, Emily Phillips, and of \$41,464.26, being an interest in the residuary estate of his uncle, Henry M. Phillips. Income to be used for the purchase of books on archaeology and philology in accordance with the terms of the bequest.

PHILLIPS PRIZE ESSAY FUND

The gift on October 5, 1888, of \$5,000 by Miss Emily Phillips, of Philadelphia, in memory of her brother Henry M. Phillips. Income to be used in the awarding of a prize for the best essay of real merit on the science and philosophy of jurisprudence.

PENROSE FUND

Bequest of one-half of the residuary estate of Dr. Richard A. F. Penrose, Jr., of Philadelphia, who died July 31, 1931, approximately \$3,900,000; by the terms of the bequest this gift to be considered an endowment fund, the income of which only is to be used and the capital to be properly invested.

PROUD LIBRARY FUND

Established by the Library Committee in May, 1911, from the proceeds of the sale in that year of duplicate pamphlets presented in 1812 by Robert Proud, Esq., of Philadelphia, \$2,500. Income to be used for the purchase of books.

PUBLICATION FUND

Contributions of approximately \$25,400 by various donors since 1914, the income to be used toward defraying the expenses of the publications of the Society. This Fund has been consolidated with the General Fund as of December 31, 1938.

SEYBERT LIBRARY FUND

Bequest of \$2,000 by Henry Seybert, Esq., of Philadelphia, who died March 3, 1883. By resolution of the Society, November, 1909 the income to be expended for the purchase of books.

TILGHMAN LIBRARY FUND

Bequest of \$200 by Chief Justice William Tilghman, of Philadelphia, who died April 30, 1827. Income to be expended for the purchase of books.

WOOD MEMORIAL FUND

Bequest of the residuary estate of Walter Wood, of Philadelphia, who died April 20, 1934, approximately \$150,000 in memory of his uncle, George B. Wood, his cousin, Horatio G. Wood, and his two brothers, Richard and Stuart Wood, all of whom were members of the American Philosophical Society; to be used by the Society first for the construction of a building that shall be adequate for the needs of the Society and if there be any surplus, then the same to be applied to such useful purpose or purposes as the Counsel (sic) and Officers of said Society may determine.

ESTIMATED INCOME FOR 1939

Unrestricted Funds

General Fund (including Admission Fees, Entertainment and Publication Funds).....	\$ 24,895.00	
Charles Francis Brush Endowment...	508.00	
The Johnson Fund.....	13,892.50	
Richard A. F. Penrose, Jr., Endowment.....	140,020.50	
		\$179,316.00

Semi-Restricted Funds

Magellanic Fund.....	\$ 168.50	
François André Michaux.....	1,824.00	
Wood Memorial Fund.....	5,406.00	
		\$ 7,398.50

*Restricted Funds**A. Library Funds*

Thomas Balch International Law.	\$ 193.10	
Martin Boyé.....	128.50	
Auguste Carlier.....	553.50	
Carnegie Library.....	4,000.00	
Benjamin Franklin.....	388.50	
Thomas Jefferson.....	145.50	
Joseph Parker Norris.....	181.00	
Henry Phillips, Jr.....	3,624.10	
Robert Proud.....	217.00	
Henry Seybert.....	145.50	
William Tilghman.....	76.00	
		\$ 9,652.70

*B. Special Funds*¹

Judson Daland.....	\$ 6,940.00	
John F. Lewis Prize.....	400.00	
Henry M. Phillips Prize Essay....	472.75	
		\$ 7,812.75
Sales of Publications.....		1,500.00
		<u>\$205,679.95</u>

¹ See Schedule VIII for Building Fund.

ESTIMATED EXPENSES FOR 1939

Executive Office.....	\$ 10,280.00
Secretaries' Expense.....	2,000.00
Telephone.....	400.00
Insurance.....	500.00
Committee on Publications.....	25,000.00
Committee on Library:	
Books and Bindings.....	10,000.00
Librarians' Salaries.....	10,150.00
Rental for Housing of Library.....	8,700.00
Treasurer's Expense and Compensation..	6,750.00
Hall Fund.....	4,000.00
Committee on Research:	
Penrose Fund.....	50,000.00
Johnson Fund.....	13,000.00
Daland Fund.....	6,000.00
Research Expense (Penrose Fund)....	1,000.00
Meetings.....	6,000.00
Miscellaneous.....	10,000.00
	<u>\$163,780.00</u>

Balances carried forward from 1938 to
pay appropriations made under the
1938 Budget

Books and Binding.....	\$ 607.00
Publication Expenses.....	16,315.19
Research Fund.....	32,234.87
	<u>\$ 49,157.06</u>

The total book value of the investments and cash held as
Principal as shown by the Accountants' report is:

Unrestricted Funds.....	\$5,484,336.58
Semi-Restricted Funds.....	633,732.21
Restricted Funds.....	474,083.70
Building Fund.....	605,920.73
	<u>\$7,198,073.22</u>

Respectfully submitted,
FIDELITY PHILADELPHIA TRUST COMPANY
TREASURER,
MARSHALL S. MORGAN, *President.*

WILSON, LINVILL & PARRY

Certified Public Accountants

Twelve South Twelfth Street
Philadelphia

February 15, 1939

ROLAND S. MORRIS, ESQ., *President*,
The American Philosophical Society,
Philadelphia, Pa.

Dear Sir:

GENERAL AND TRUST FUNDS

We have examined the accounts of the American Philosophical Society for the year ended December 31, 1938, as contained in the records of the Treasurer, the Fidelity-Philadelphia Trust Company. The appended statements, Schedules I to VII inclusive, are in accordance with these records.

We have examined paid cancelled checks and vouchers in connection with disbursements in the various funds except the Wood Fund Real Estate Income Account, as to which we have accepted the cash records of the Fidelity-Philadelphia Trust Company as agent, without any further examination. The cash in bank at December 31, 1938, as summarized in Schedule VI, has been verified.

We have examined into the changes during the year in the investments in all of the funds. We examined the perpetual fire insurance policies carried as an investment in the General Fund and obtained detailed statements from the Fidelity-Philadelphia Trust Company and the Girard Trust Company, showing at December 31, 1938, the bonds, stocks, real estate and other investments held by them as agents for the Society, thus satisfactorily accounting for all of the investments of the Society as called for by the records at December 31, 1938.

The personalty acquired during the year as a bequest from the Estate of Judson Daland, deceased, is in accordance with the records of the Treasurer and a signed copy of the schedule of distribution in adjudication.

The investments composing the various funds as summarized in the appended statement (Schedule VII) are at book value, which in most instances is par or face value and is not represented to be either

original cost or present market value. The Real Estate owned is shown at its appraised or assessed valuation. We have not determined the current market value of any of the investments.

Income due for the year from the investments, has been received and recorded on the books prior to December 31st except as follows:

General and Other Trust Funds:

Bond Interest in Default.....	\$1,957.10
(Including \$1,367.10 in default January 1, 1938)	
Carnegie Library Fund:	
Delinquent Mortgage Interest.....	1,618.67
(Including \$641.67 in default January 1, 1938)	
	\$3,575.77

We do not list as in arrears, interest originally due November 1, 1938, from issues of the Lehigh Valley Railroad Company, which issues are subject to extension plan and agreement, dated August 25, 1938, under which 75 per cent of the interest has been deferred and only 25 per cent paid.

Comprehensive tests have been made of the income receivable from other sources, except as to real estate, for which we have not examined leases, rental statements or other data in connection with income recorded as being received.

BUILDING FUND

Girard Trust Company, Trustee

We have examined statements submitted by the Girard Trust Company, Trustee, of the Building Fund for the year ended December 31, 1938, have examined the records in the Society's office of subscriptions or pledges to the fund, and have prepared the appended statement of Cash Receipts and Disbursements and Summary of the Assets for the year—Schedules VIII and IX.

The cash and investments are in accordance with a statement obtained by us from the Girard Trust Company, Trustee, setting forth in detail the assets in their possession at December 31, 1938. All of the investments are at par value except stocks, which are at cost, with real estate (participations) at amount of foreclosed mortgage plus costs of acquisition and subsequent improvements.

We have not determined the present market value of any of the investments, or the collectibility of the unpaid pledges to the fund.

We have examined into the changes during the year in the investments, and have accounted for all income due except delinquent mortgage interest \$2,696.91, of which amount \$1,083.40 was delinquent January 1, 1938. This delinquency does not include a second mortgage participation of \$2,192.50 (or the interest in arrears on same) which was accepted in lieu of interest in arrears June 1, 1932, to April 14, 1937, on a first mortgage participation. This second mortgage participation is not listed among the assets.

Respectfully submitted,

WILSON, LINVILL & PARRY,

Certified Public Accountants.

SCHEDULE I

CASH RECEIPTS AND DISBURSEMENTS

Year ended December 31, 1938

GENERAL FUND

Principal Account

Balance, January 1, 1938 (including unexpended balance of Admission Fees, Entertainment and Publication Funds)..... \$ 10,602.07

Receipts:

Investments redeemed:

Mortgage 41 E. Mt. Pleasant Ave. satisfied..... \$ 2,500.00

Walter Wood Real Estate Principal Account:

Payment on account of advances by General Fund 110,000.00

Transferred from Income..... 50,000.00

162,500.00

\$173,102.07

Disbursements:

Investments purchased:

Government Bonds (\$50,000.00)..... \$ 51,000.00

Preferred Stocks..... 56,087.94

Common Stocks..... 60,715.96

167,803.90

Balance, December 31, 1938..... \$ 5,298.17

Income and Operating Account

Balance, January 1, 1938..... \$ 49,348.47

Receipts:

Income from Investments..... \$ 28,098.93

Girard Trust Co. Building Fund Reimbursement for alterations, refitting, and furnishing Society's building..... 6,478.35

Sale of publications..... 1,763.77

Royalties on W. B. Scott's book, "History of Land Mammals in the Western Hemisphere"..... 1,009.39

Sale of microfilms..... 46.97

Sale of duplicate books..... 27.00

Exchange checks..... 4.05

Transfer of Income from Trust Funds:

Richard A. F. Penrose, Jr., Endowment Fund..... \$142,610.95

The Johnson Fund..... 20,850.00

Carnegie Library Fund..... 4,148.56

Charles Francis Brush Endowment Fund..... 495.28

168,104.79

205,533.25

Amount forwarded..... \$254,881.72

Amount brought forward..... \$254,881.72

Disbursements:

Salaries—Executive Office.....	\$ 9,680.00
Salaries—Librarian and Assistant Librarians.....	9,892.50
Secretaries' Expenses.....	2,075.34
Telephone.....	400.12
Publication Expenses.....	21,765.57
Books and Binding.....	10,785.52
Insurance.....	81.60
Meetings.....	5,625.51
American Historical Association Meeting.....	1,097.61
Hall Expenses.....	2,901.50
Hall Equipment, Alterations and Repairs.....	7,715.65
Library Rental (Drexel Building).....	8,450.00
Auditing Fees.....	850.00
Treasurer's Expense.....	60.25
Research Fund Grants.....	97,747.51
Research Expenses.....	173.49
Refunds—Prepaid Annual Dues.....	85.00
Camera Expenses.....	267.65
Refund—Building Fund Subscription.....	250.00
Bronze Medallion Portrait—Dr. Henry H. Donaldson.....	25.00
Exchange Checks.....	4.05
Forwarding charges—sale of bonds.....	5.67
Treasurer's Commissions.....	\$ 5,697.71
Agent's Commission (Girard Trust Com- pany, Carnegie Fund).....	46.08

\$ 5,743.79

Charged other Funds..... 5,039.23

704.56

Transfer to Principal..... 50,000.00

\$230,644.10

Balance, December 31, 1938..... \$ 24,237.62

Note:

The following General Fund appropriations for 1938
balances are carried forward:

Books and Binding.....	\$ 607.00
Publication Expenses.....	16,315.19
Research Fund.....	32,234.87
	<u>\$ 49,157.06</u>

SCHEDULE II SUMMARY OF CASH RECEIPTS AND DISBURSEMENTS

Year ended December 31, 1933

TRUST FUNDS—PRINCIPAL ACCOUNT*						
	Receipts			Disbursements		
	Balance 1-1-38	Proceeds from Investments Sold or Matured	Transferred from Income Account	Total	Investments Purchased	Balance 12-31-38
<i>Unrestricted Funds:</i>						
Charles Francis Brush Endowment.....	\$ 10.00	—	—	\$ 10.00	—	\$ 10.00
The Johnson Fund.....	199.78	\$ 58,650.00	\$1,546.02	60,395.80	\$ 37,038.61	22,757.19
Richard A. F. Penrose, Jr., Endowment.....	9,315.38	362,653.96	—	371,974.34	326,544.24†	45,430.10
	<u>\$ 9,525.16</u>	<u>\$421,303.96</u>	<u>\$1,546.02</u>	<u>\$432,380.14</u>	<u>\$364,182.85</u>	<u>\$68,197.29</u>
<i>Semi-Restricted Funds:</i>						
Magellan Fund.....	\$ 66.57	\$ 4,200.00	\$ 122.46	\$ 4,389.03	\$ 4,000.00	\$ 389.03
François André Michaux.....	217.19	11,550.00	403.53	12,230.72	11,075.67	555.05
	<u>\$ 283.76</u>	<u>\$ 15,750.00</u>	<u>\$ 525.99</u>	<u>\$ 16,619.75</u>	<u>\$ 15,075.67</u>	<u>\$ 944.08</u>
<i>Restricted Funds:</i>						
<i>Library Funds</i>						
Thomas Balch International Law.....	\$ 167.20	—	\$ 95.55	\$ 262.75	\$ 87.83	\$ 174.92
Martin Boyé.....	47.36	—	12.85	60.21	—	60.21
Auguste Carlier.....	80.91	—	55.35	136.26	—	136.26
Carnegie Library.....	—	\$ 1,800.00	—	1,800.00	1,113.54 †	686.46
					2.62 }	
Benjamin Franklin.....	42.15	—	17.65	59.80	—	59.80
Thomas Jefferson.....	93.64	—	14.35	107.99	87.84	20.15
Joseph Parker Norris.....	38.04	—	18.10	56.14	—	56.14
Henry Phillips, Jr.....	403.28	1,060.00	377.80	1,841.08	351.33	1,489.75
Robert Proud.....	105.32	—	21.50	126.82	87.83	38.99
Henry Seybert.....	60.48	—	14.55	75.03	—	75.03
William Tilghman.....	52.65	—	7.60	60.25	—	60.25
	<u>\$ 1,091.03</u>	<u>\$ 2,860.00</u>	<u>\$ 635.30</u>	<u>\$ 4,586.33</u>	<u>\$ 1,730.99</u>	<u>\$ 2,855.34</u>
<i>Special Funds</i>						
Judson Daland.....	—	1,050.00	968.39	2,018.39	—	2,018.39
John F. Lewis Prize.....	40.00	—	134.50	174.50	—	174.50
Henry M. Phillips Prize Essay.....	77.78	—	47.28	125.06	—	125.06
	<u>\$ 1,208.81</u>	<u>\$ 3,910.00</u>	<u>\$1,785.47</u>	<u>\$ 6,904.28</u>	<u>\$ 1,730.99</u>	<u>\$ 5,173.29</u>
Totals.....	<u>\$11,017.73</u>	<u>\$440,968.96</u>	<u>\$3,917.48</u>	<u>\$455,904.17</u>	<u>\$381,589.51</u>	<u>\$74,314.66</u>

* Exclusive of: Wood Fund—See Schedules IV and V. Building Fund—See Schedules VIII and IX.

† Includes Federal and State Transfer taxes on Stock purchases, \$10.62.
‡ Insurance and postage re collection of bond maturity.

SCHEDULE III SUMMARY OF CASH RECEIPTS AND DISBURSEMENTS

Year ended December 31, 1938

TREASURY FUNDS—INCOME ACCOUNT*

	Receipts		Disbursements				Balance 1-1-38	Total	Balance 12-31-38
	Gross Income from Invest- ments	For Purpose of Fund	Treasurer's and Agent's Commis- sions and Misc.	Trans- ferred to General Fund	Trans- ferred to Principal Account				
<i>Unrestricted Funds:</i>									
Charles Francis Brush Endowment.....	—	\$ 508.00	\$ 508.00	—	\$ 12.72	\$ 495.28	\$ 508.00	—	—
The Johnson Fund.....	\$20,960.72	15,444.31	36,405.03	—	399.29	20,850.00	\$1,546.02	22,795.31	\$13,609.72
Richard A. F. Penrose, Jr., Endowment	—	146,713.20	146,713.20	—	4,102.25	142,610.95	—	146,713.20	—
	<u>\$20,960.72</u>	<u>\$162,655.51</u>	<u>\$183,626.23</u>	<u>—</u>	<u>\$4,514.26</u>	<u>\$163,956.23</u>	<u>\$1,546.02</u>	<u>\$170,016.51</u>	<u>\$13,609.72</u>
<i>Semi-Restricted Funds:</i>									
Magellanic Fund.....	\$ 185.49	\$ 190.98	\$ 376.47	\$ 89.71	\$ 5.56	—	\$ 122.46	\$ 217.73	\$ 158.74
François André Michaux.....	2,148.87	1,869.32	4,018.19	1,854.66	50.00	—	463.53	2,368.19	1,650.00
	<u>\$ 2,334.36</u>	<u>\$ 2,060.30</u>	<u>\$ 4,394.66</u>	<u>\$1,944.37</u>	<u>\$ 55.56</u>	<u>—</u>	<u>\$ 585.99</u>	<u>\$ 2,585.92</u>	<u>\$ 1,808.74</u>
<i>Restricted Funds:</i>									
<i>Library Funds</i>									
Thomas Balch International Law.	\$ 126.61	\$ 191.10	\$ 317.71	\$ 8.76	\$ 4.76	—	\$ 95.55	\$ 109.07	\$ 208.64
Martin Boyé.....	80.66	128.50	209.16	11.38	3.20	—	12.85	27.43	181.73
Auguste Carier.....	2.18	553.48	555.66	172.96	13.84	—	55.35	242.15	313.51
Carnegie Library.....	—	4,607.09	4,607.09	—	459.13	\$ 4,148.56	—	4,607.69	—
Benjamin Franklin.....	4.69	388.50	393.19	365.82	9.72	—	17.65	393.19	—
Thomas Jefferson.....	59.24	143.49	202.73	67.98	3.57	—	14.35	85.90	116.83
Joseph Parker Norris.....	54.24	181.00	235.24	54.81	4.54	—	18.10	77.45	157.79
Henry Phillips, Jr.....	2,239.87	3,778.04	6,017.91	2,426.69	94.66	—	377.80	2,899.15	3,118.76
Robert Proud.....	71.51	215.00	286.51	42.16	5.37	—	21.50	69.03	217.48
Henry Seybert.....	36.62	146.51	182.03	27.84	3.62	—	14.55	46.01	136.02
William Tilghman.....	12.06	76.00	88.06	44.04	1.92	—	7.60	53.56	34.50
	<u>\$ 2,687.53</u>	<u>\$ 10,408.31</u>	<u>\$ 13,095.89</u>	<u>\$3,222.44</u>	<u>\$ 604.33</u>	<u>\$ 4,148.56</u>	<u>\$ 635.30</u>	<u>\$ 8,610.63</u>	<u>\$ 4,455.26</u>
<i>Special Funds</i>									
Judson Daland.....	—	9,683.93†	9,683.93	3,000.00	2,863.72	—	968.39	6,832.11	2,851.82
John F. Lewis Prize.....	394.50	400.00	794.50	310.00	10.00	—	134.50	454.50	340.00
Henry M. Phillips Prize Essay....	402.18	472.76	874.94	—	11.82	—	47.28	59.10	815.84
	<u>\$ 3,484.26</u>	<u>\$ 20,965.00</u>	<u>\$ 24,449.26</u>	<u>\$6,532.44</u>	<u>\$3,489.87</u>	<u>\$ 4,148.56</u>	<u>\$1,785.47</u>	<u>\$ 15,956.34</u>	<u>\$ 8,492.92</u>
Totals.....	<u>\$26,779.34</u>	<u>\$185,690.81</u>	<u>\$212,470.15</u>	<u>\$8,476.81</u>	<u>\$8,059.69</u>	<u>\$168,104.79</u>	<u>\$3,917.48</u>	<u>\$188,558.77</u>	<u>\$23,911.38</u>

SCHEDULE IV

CASH RECEIPTS AND DISBURSEMENTS

Year ended December 31, 1938

WOOD FUND—PERSONALTY

Principal Account

Balance January 1, 1938.....	\$ 7,788.79
Receipts:	
Cash from Executors of Estate of Walter Wood, deceased	
Balance in Real Estate Account.....	\$12,482.76
On account of Personal Estate.....	89,260.66
Investments sold or redeemed.....	231.14
	<u>101,974.56</u>
	\$109,763.35
Disbursements:	
Transferred to Wood Fund—Real Estate.....	109,443.42
Balance December 31, 1938.....	<u>\$ 319.93</u>

Income Account

Balance January 1, 1938.....	\$ 7,358.01
Receipts:	
Income from Investments.....	5,416.77
	<u>\$ 12,774.78</u>
Disbursements:	
Treasurer's Commission.....	\$ 270.85
Postage and Insurance.....	.27
	<u>271.12</u>
Balance December 31, 1938.....	<u>\$ 12,503.66</u>

* Exclusive of: Wood Fund—See Schedules IV and V. Building Fund—See Schedules VIII and IX.
† Includes \$6,461.43 received from the Executors of the Estate of Judson Daland, deceased.

SCHEDULE V

CASH RECEIPTS AND DISBURSEMENTS

Year ended December 31, 1938

WOOD FUND—REAL ESTATE

Principal Account

Balance January 1, 1938.....	\$	702.58
Receipts:		
Transferred from Wood Fund—Personalty.....	\$109,443.42	
Recovery of damages to door—400 Chestnut Street...	100.00	
		<u>109,543.42</u>
		\$110,246.00
Disbursements:		
Payment on account of loan—General Fund Principal	\$110,000.00	
Appraisal fee—1620 Locust Street.....	5.00	
		<u>110,005.00</u>
Balance December 31, 1938.....	\$	241.00

Income Account

Balance January 1, 1938.....	\$	3,384.81
Receipts:		
Income from Real Estate.....	\$ 47,265.07	
Adjustment and Cancellation of Insurance.....	479.24	
Refund of Taxes.....	17.84	
Reimbursement for excess Water Rent.....	292.28	
Coal Royalties—Walker County, Georgia.....	246.30	
Miscellaneous.....	22.42	
		<u>48,323.15</u>
		\$ 51,707.96
Disbursements:		
Taxes on Real Estate.....	\$ 15,016.62	
Water Rents.....	553.92	
Maintenance, Repairs and Insurance.....	25,979.87	
General Fund Income—Interest on advances.....	3,788.33	
Commission on Real Estate Sales 1936 and 1937.....	399.50	
Fee for Assessment Reduction.....	142.41	
Treasurer's Commission.....	354.28	
Miscellaneous.....	20.25	
		<u>46,255.18</u>
Balance December 31, 1938.....	\$	5,452.78

SCHEDULE VI

SUMMARY OF CASH

December 31, 1938

	Principal	Income	Total
<i>Unrestricted Funds</i>			
General.....	\$ 5,298.17	\$24,237.62	\$ 29,535.79
Charles Francis Brush Endowment.....	10.00		10.00
The Johnson Fund.....	22,757.19	13,609.72	36,366.91
Richard A. F. Penrose, Jr., Endowment....	45,430.10		45,430.10
	<u>\$73,495.46</u>	<u>\$37,847.34</u>	<u>\$111,342.80</u>
<i>Semi-Restricted Funds</i>			
Magellanic Fund.....	\$ 389.03	\$ 158.74	\$ 547.77
François André Michaux	555.05	1,650.00	2,205.05
Wood Memorial Fund			
Personalty.....	319.93	12,503.66	12,823.59
Real Estate.....	241.00	5,452.78	5,693.78
	<u>\$ 1,505.01</u>	<u>\$19,765.18</u>	<u>\$ 21,270.19</u>
<i>Restricted Funds</i>			
<i>Library Funds</i>			
Thomas Balch International Law.....	\$ 174.92	\$ 208.64	\$ 383.56
Martin Boyé	60.21	181.73	241.94
Auguste Carlier.....	136.26	313.51	449.77
Carnegie Library.....	683.84		683.84
Benjamin Franklin.....	59.80		59.80
Thomas Jefferson	20.15	116.83	136.98
Joseph Parker Norris.....	56.14	157.79	213.93
Henry Phillips, Jr.	1,489.75	3,118.76	4,608.51
Robert Proud.....	38.99	217.48	256.47
Henry Seybert.....	75.03	136.02	211.05
William Tilghman.....	60.25	34.50	94.75
	<u>\$ 2,855.34</u>	<u>\$ 4,485.26</u>	<u>\$ 7,340.60</u>
<i>Special Funds</i>			
Judson Daland.....	2,018.39	2,851.82	4,870.21
John F. Lewis Prize.....	174.50	340.00	514.50
Henry M. Phillips Prize Essay.....	125.06	815.84	940.90
	<u>\$ 5,173.29</u>	<u>\$ 8,492.92</u>	<u>\$ 13,666.21</u>
Totals.....	<u>\$80,173.76</u>	<u>\$66,105.44</u>	<u>\$146,279.20</u>
On deposit with Fidelity-Philadelphia Trust Company (Treasurer's Account).....			66,105.44
Included among the Trust Funds (Cash) of Fidelity-Philadelphia Trust Company....			79,489.92
Included among the Trust Funds (Cash) of Girard Trust Co. (Carnegie Library Fund).			683.84
			<u>\$146,279.20</u>

SCHEDULE VII

GENERAL AND SPECIAL FUNDS

PRINCIPAL

December 31, 1938

	Unin- vested Cash 12-31-1938	Invested 12-31-1938	Total Funds at Book Value 12-31-1938	Total Funds at Book Value 12-31-1937
<i>Unrestricted Funds:</i>				
General (Including Admission Fees, Entertainment and Publication Funds)	\$ 5,298.17	\$ 455,611.97	—	—
Loan to Wood Fund.		100,000.00A		
	<u>\$ 5,298.17</u>	<u>\$ 555,611.97</u>	<u>\$ 560,910.14</u>	<u>\$ 546,996.59</u>
Charles Francis Brush En- dowment.	\$ 10.00	\$ 10,100.00	\$ 10,110.00	\$ 10,110.00
The Johnson Fund.	\$22,757.19	\$ 480,813.81	\$ 503,571.00	\$ 498,374.98
Richard A. F. Penrose, Jr., Endowment.	\$45,430.10	\$4,364,315.34	\$4,409,745.44	\$4,478,342.28
Total Unrestricted Funds	<u>\$73,495.46</u>	<u>\$5,410,841.12</u>	<u>\$5,484,336.58</u>	<u>\$5,533,823.85</u>
<i>Semi-Restricted Funds:</i>				
Magellanic Fund				
Prize for discovery or in- vention and for books in field of Navigation, As- tronomy or National Phi- losophy.	<u>\$ 389.03</u>	<u>\$ 4,700.00</u>	<u>\$ 5,089.03</u>	<u>\$ 4,766.57</u>
François André Michaux				
For books on Forestry	<u>\$ 555.05</u>	<u>\$ 49,000.00</u>	<u>\$ 49,555.05</u>	<u>\$ 48,617.19</u>
Wood Memorial Fund				
Personalty.	\$ 319.93	\$ 97,800.00	—	—
Real Estate.	241.00	580,727.20	—	—
Loan due General Fund. . .	—	-100,000.00A	—	—
For the construction of a building adequate to the needs of the Society, any surplus remaining to be applied to such useful purposes as coun- sel and officers of So- ciety may determine				
	<u>\$ 560.93</u>	<u>\$ 578,527.20</u>	<u>\$ 579,088.13</u>	<u>\$ 485,527.55</u>
Total Semi- Restricted Funds.	<u>\$ 1,505.01</u>	<u>\$ 632,227.20</u>	<u>\$ 633,732.21</u>	<u>\$ 538,911.31</u>

Restricted Funds:

Library Funds

Thomas Balch International

Law

For books relating to the

Law of Nations..... \$ 174.92 \$ 3,110.00 \$ 3,284.92 \$ 3,227.20

Martin Boyé

For books—Chemistry

and Geology..... \$ 60.21 \$ 3,000.00 \$ 3,060.21 \$ 3,047.36

Auguste Carlier

For books..... \$ 136.26 \$ 12,950.00 \$ 13,086.26 \$ 13,030.91

Carnegie Library

For maintenance of Li-

brary..... \$ 683.84 \$ 99,333.76 \$ 100,017.60 \$ 100,020.22

Benjamin Franklin

For books..... \$ 59.80 \$ 9,400.00 \$ 9,459.80 \$ 9,442.15

Thomas Jefferson

For books..... \$ 20.15 \$ 3,450.00 \$ 3,470.15 \$ 3,493.64

Joseph Parker Norris

For books..... \$ 56.14 \$ 4,350.00 \$ 4,406.14 \$ 4,388.04

Henry Phillips, Jr.

For books on Archaeology

and Philology..... \$ 1,489.75 \$ 82,120.00 \$ 83,609.75 \$ 83,323.28

Robert Proud

For books..... \$ 38.99 \$ 5,150.00 \$ 5,188.99 \$ 5,205.32

Henry Seybert

For books..... \$ 75.03 \$ 3,450.00 \$ 3,525.03 \$ 3,510.48

William Tilghman

For books..... \$ 60.25 \$ 1,800.00 \$ 1,860.25 \$ 1,852.65

Total..... \$ 2,855.34 \$ 228,113.76 \$ 230,969.10 \$ 230,541.25

Special Funds

Judson Daland

For research in clinical

medicine..... \$ 2,018.39 \$ 218,796.65 \$ 220,815.04 —

John F. Lewis Prize

For an award to the Amer-

ican Citizen who shall an-

nounce at any general or

special meeting of the So-

ciety and publish among

its papers some truth

which the Council of the

Society shall deem worthy

of the award..... \$ 174.50 \$ 10,000.00 \$ 10,174.50 \$ 10,040.00

Henry M. Phillips Prize Es-

say

Prize for essay on Science
and Philosophy of Juris-
prudence.....

	\$ 125.06	\$ 12,000.00	\$ 12,125.06	\$ 12,077.78
Total Restricted Funds	\$ 5,173.29	\$ 468,910.41	\$ 474,083.70	\$ 252,659.03
Total All Funds.....	\$80,173.76	\$6,511,978.73	\$6,592,152.49	\$6,325,394.19

Invested in:

U. S. Government Obligations	\$2,226,000.00	\$2,167,500.00
State, County and Municipal Bonds.....	944,000.00	1,276,000.00
Railway, Utility, Industrial and Other Bonds.....	1,420,701.00	1,378,501.00
Stocks.....	1,256,922.07	801,030.92
Mortgages and Mortgage Par- ticipations.....	75,221.74	77,921.74
Real Estate and Real Estate Participations.....	588,349.22	587,235.68
Notes Receivable.....	—	6,308.98
Perpetual Fire Insurance Poli- cies.....	784.70	784.70
	\$6,511,978.73	\$6,295,283.02
Uninvested Cash.....	80,173.76	30,111.17
	\$6,592,152.49	\$6,325,394.19

SUMMARY OF INCREASE IN INVESTMENTS

Balance at Book Value 12-31-1937.....	\$6,295,283.02
Investments from Executors of Estate of Judson Daland, de- ceased—per Schedule of Distribution.....	219,953.90
Stock Dividend of 1½ per cent, received on Standard Oil Co. of New Jersey Stock held in the General and Judson Daland Funds at par value.....	375.00
Investments Purchased at cost.....	549,380.17
	7,064,992.09
Investments sold (\$443,700.10) at book value.....	\$433,059.98
Investment charged off at book value.....	2,000.00
	\$ 435,059.98
	\$6,629,932.11
Deduct:	
Difference between cost of Investments Purchased during year and the Face or Par Value at which these Investments are shown on the books:	
Bonds.....	\$ 4,937.50
Stocks.....	113,015.88
	117,953.38
Balance at Book Value 12-31-1938.....	\$6,511,978.73

SCHEDULE VIII

BUILDING FUND—GIRARD TRUST COMPANY, TRUSTEE

CASH RECEIPTS AND DISBURSEMENTS

*Year ended December 31, 1938**Principal Account*

Balance January 1, 1938.....	\$ 5,964.36
Receipts:	
Investment in Stock Sold.....	\$29,643.90
Mortgages paid in full or in part.....	43,306.06
Real Estate—Settlements arising out of foreclosure....	126.20
Balance of Abated Legacy—Estate of Henry G. Bryant, Deceased.....	246.38
Transferred from Income Account.....	17,631.51
	<u>90,954.05</u>
	\$96,918.41
Disbursements:	
Invested in Bonds.....	\$72,156.25
Invested in Stocks.....	10,100.00
Cost of Acquiring Real Estate.....	2,409.06
Transferred to General Fund in reimbursement for al- terations, refitting and furnishing Society's building..	6,478.35
Forwarding charges on Investments Purchased and Sold	9.76
	<u>91,153.42</u>
Balance December 31, 1938.....	<u><u>\$ 5,764.99</u></u>

Income Account

Receipts:	
Income from Investments.....	\$21,250.81
Disbursements:	
Real Estate expenses.....	\$ 2,880.10
Commission—Girard Trust Company.....	212.51
Notary Fee.....	.50
Transferred to Principal Account.....	17,631.51
Accrued Interest on Bonds Purchased.....	526.19
	<u>\$21,250.81</u>

SCHEDULE IX

BUILDING FUND—GIRARD TRUST COMPANY, TRUSTEE

SUMMARY OF ASSETS

	Balance 1-1-1938	Additions	Deductions	Balance 12-31-1938
Pledges Receivable.....	\$ 11,229.17	—	—	\$ 11,229.17
Investments:				
Bonds (Par Value).....	110,500.00	75,000.00	—	185,500.00
Stocks (At Cost).....	118,044.13	10,100.00	28,500.00	99,644.13
Mortgages			25,866.67*	
(Participations)....	266,432.84	—	43,306.06	197,260.11
Real Estate		25,866.67*		
(Participations).....	89,601.97	2,409.06	126.20	117,751.50
Cash—Principal.....	5,964.36	90,954.05	91,153.42	5,764.99
Cash—Income.....	—	21,250.81	21,250.81	—
	<u>\$601,772.47</u>	<u>\$225,580.59</u>	<u>\$210,203.16</u>	<u>\$617,149.90†</u>

SUMMARY OF INCREASE IN FUNDS

Year ended December 31, 1938

Income from Investments.....	\$21,250.81	
Less accrued interest on Bonds Purchased	526.19	
	<u>—</u>	\$ 20,724.62
Balance of abated Legacy—Estate of Henry G. Bryant, deceased		246.38
Discounts on Bonds Purchased (net of premium paid) ..		2,843.75
Profit on Sale of Stock.....		1,143.90
		<u>\$ 24,958.65</u>
Less:		
Real Estate Expenses.....	\$ 2,880.10	
Transferred to General Fund in reimbursement for alterations, refitting and furnishing Society's building.....		6,478.35
Commission—Girard Trust Company.....		212.51
Forwarding Charges on Investments Purchased and Sold.....		9.76
Notary Fee.....		.50
		<u>9,581.22</u>
		\$ 15,377.43
Balance January 1, 1938.....		<u>601,772.47</u>
Balance December 31, 1938.....		<u><u>\$617,149.90</u></u>

* Face value of mortgages foreclosed and real estate acquired.

† Includes bonds at Par Value. Total Fund including bonds at cost is \$614,036.15.

VI

AWARDS OF PRIZES

MAGELLANIC FUND, established in 1786 by the gift of 200 guineas by John Hyacinth de Magellan, of London, for a gold medal to be annually awarded under prescribed terms, to the author of the best discovery or most useful invention relating to navigation, astronomy, or natural philosophy (mere natural history only excepted). Any surplus of interest remaining to be used for such purposes as may be authorized under the Society's Charter and Laws.

Awards of the Magellanic Premium

- December 1790. To *Francis Hopkinson, Philadelphia, Penna.* For the Invention of the Spring Block. "Description of a Spring Block Designed to Assist a Vessel in Sailing" (TRANS. Amer. Philos. Soc. 3, Art. 40, 1793).
- December 1792. To *Robert Patterson, Philadelphia, Penna.* For the Improvement of Electrical Rods, or Lightning Conductors, by Pointing them with Black-lead. "An Improvement on Metallic Conductors or Lightning-rods in a Letter to Dr. David Rittenhouse from Robert Patterson" (TRANS. Amer. Philos. Soc. 3, Art. 35, 1793).
- December 1792. To *William Thornton, London, England.* For "Cadmus" or a Philosophical Dissertation on the Elements of Written Language. "Cadmus, or a Treatise on the Elements of Written Language, illustrating, by a Philosophical Division of Speech, the power of each Character, thereby mutually fixing the Orthography and Orthoepey. With an Essay on the Mode of Teaching the Surd, or Deaf and Consequently Dumb to Speak" (TRANS. Amer. Philos. Soc. 3, Art. 33, 1793).
- December 1794. To *Nicolas Collin, Philadelphia, Penna.* For a Paper on an Elevator (Nititor [sic] in ardua virtus). "Description of a Speedy Elevator by the Inventor" (TRANS. Amer. Philos. Soc. 4, Art. 75, 1799).
- November 1804. To *Captain William Mugford, Salem, Mass.* For the Invention of a Temporary Rudder. "An account and description of a Temporary Rudder Invented by Capt. William Mugford of Salem, Mass." (TRANS. Amer. Philos. Soc. 6, Art. 34, 1809).

- December 1804. To *Dr. Ben. Smith Barton, Philadelphia, Penna.* For a Paper on a "Number of the Pernicious Insects of the United States."
- October 1807. To *John Garnett, New Brunswick, N. J.* For a Paper on "A New Simple Nautical Chart." "Description and use of a new and simple Nautical Chart, for working the different problems in Navigation" (TRANS. Amer. Philos. Soc. 6, Art. 49, 1809).
- April 1809. To *James Humphries, Jr., Philadelphia, Penna.* For a Model and Description of Steering Apparatus.
- April 1820. To *Joshua Chapman, Bristol, Penna.* For an Improvement in the Manufacture of Canvas.
- March 1823. To *Dr. Jas. Ewing, Philadelphia, Penna.* For the invention of the "Improved Hydrant."
- May 1825. To *C. C. Brodie.* For an invention to repair the side of ships, under the surface of the water.
- March 1836. To *James P. Espy, Philadelphia, Penna.* Author of the paper signed "Investigator."
- December 1864. To *Pliny Earle Chase, Philadelphia, Penna.* For a paper on "The discovery of Certain new relations between the solar- and lunar-diurnal variations of magnetic force and of barometric pressure" (PROC. Amer. Philos. Soc. 9: 487-495).
- December 1887. To *Lewis M. Haupt, Philadelphia, Penna.* For a paper on "The Physical Phenomena of Harbor Entrances. Their Causes and Remedies. Defects of Present Methods of Improvement" (PROC. Amer. Philos. Soc. 25: 19-41).
- April 1922. To *Paul R. Heyl and Lyman J. Briggs, U. S. Bureau of Standards, Washington, D. C.* For the invention of the Earth Inductor Compass. "The Earth Inductor Compass" (PROC. Amer. Philos. Soc. 61: 15-32).

THE HENRY M. PHILLIPS PRIZE ESSAY FUND, established in 1888 by the gift of \$5,000 by Miss Emily Phillips, of Philadelphia. Income to be used in the awarding of a prize for the best essay of real merit on the science and philosophy of jurisprudence.

Awards of The Henry M. Phillips Prize Essay

- May 1895. To *George H. Smith, Esq., Los Angeles, Calif.* \$500. "The Theory of State" (PROC. Amer. Philos. Soc. 34: 181-334).
- June 1900. To *W. H. Hastings, Esq., Wilber, Neb.* \$2,000. "The Development of Law as Illustrated by the Decisions Relating to the Police Power of the State" (PROC. Amer. Philos. Soc. 39: 359-554).

- April 1912. To *Charles H. Burr, Esq., Philadelphia, Penna.* \$2,000. "The Treaty-Making Power of the United States and the Methods of its Enforcement as Affecting the Police Powers of the States" (Proc. Amer. Philos. Soc. 51: 271-422).
- April 1921. To *Quincy Wright, Esq., Minneapolis, Minn.* \$2,000. "The Relative Rights, Duties and Responsibilities of the President, of the Senate and the House, and of the Judiciary in Theory and Practice" (Proc. Amer. Philos. Soc. 60: 99-455).
- October 1935. To *Lon L. Fuller, Dean of the Law School, Duke University, Durham, N. C.* \$1,500 and Diploma. "American Legal Realism" (Proc. Amer. Philos. Soc. 76: 191-235).

THE JOHN F. LEWIS FUND, established in 1935 by the gift of Mrs. John F. Lewis, of Philadelphia, of \$10,000 in memory of her late husband; the income to be used each year as an award to the American citizen who shall announce at any general or special meeting of the Society, and publish among its papers, some truth which the Council of the Society shall deem worthy of the award.

Awards of The John F. Lewis Prize

- April 1937. To *Ralph E. Cleland, Goucher College, Baltimore, Md.* \$300 and Diploma, for presentation to the Society and publishing in its PROCEEDINGS: "Cyto-taxonomic Studies on Certain *Oenotheras* from California" (Read April 19, 1934,—Proc. Amer. Philos. Soc. 75: 339-429). "A Cyto-genetic and Taxonomic Attack upon the Phylogeny and Systematics of *Oenothera* (Evening Primrose) with Special Reference to the Sub-genus *Onagra*" (Read April 18, 1935,—Proc. Amer. Philos. Soc. 77: 477-544).
- April 1938. To *Arthur J. Dempster, University of Chicago, Chicago, Ill.* \$300 and Diploma, for presentation to the Society and publishing in its PROCEEDINGS: "New Methods in Mass Spectroscopy" (Read in part April 20, 1935,—Proc. Amer. Philos. Soc. 75: 755-767). "Further Experiments on the Mass Analysis of the Chemical Elements" (Read April 25, 1936,—Proc. Amer. Philos. Soc. 76: 491-496).

VII

GENERAL MEETING LECTURERS

THE R. A. F. PENROSE, JR., LECTURERS

- 1934. Edwin G. Conklin
 “A Generation’s Progress in the Study of Evolution”
- 1935. W. F. G. Swann
 “Is the Universe Running Down?”
- 1936. Dixon Ryan Fox
 “The American Tradition in a New Day”
- 1937. Irving Langmuir
 “The Surfaces of Solids and Liquids”
- 1938. S. A. Mitchell
 “With an Astronomer on an Eclipse Expedition”

THE AUTUMN LECTURERS

- 1936. D’Arcy W. Thompson
 “Astronomy in the Classics”
- 1937. William Lyon Phelps
 “Truth and Poetry”
- 1938. Alfred J. Lotka
 “Contacts of Population Study with Related Branches of Science”

VIII

REPRESENTATION AT CELEBRATIONS OF SOCIETIES, INSTITUTIONS, ETC.

April 1-2. Forty-second Annual Meeting of the American Academy of Political and Social Sciences, Philadelphia, Pa. Edward P. Cheyney and Conyers Read.

April 12. Inauguration of Alfred Atkinson as President of the University of Arizona, Tucson, Ariz. Vesto M. Slipher.

May 19-21. Dedication of the Franklin Institute of the State of Pennsylvania in honor of Benjamin Franklin and the unveiling of an heroic statue of this distinguished American, Philadelphia, Pa. Roland S. Morris and Edwin G. Conklin.

September 6-9. Sesquicentennial Celebration of the Founding of the American Mathematical Society held at Columbia University, Ithaca, N. Y. Luther P. Eisenhart.

American Council of Learned Societies, Washington, D. C.

(for four years, 1937-41). Edward Capps.

(for four years, 1938-42). William E. Lingelbach.

National Research Council, Division of Foreign Relations, Washington, D. C. (for three years, 1937-40). Leo S. Rowe.

IX

LIST OF MEMBERS

MEMBERS RESIDING WITHIN THE UNITED STATES

	Date of Election
Abbot, Charles Greeley, M.Sc., D.Sc., LL.D. Astrophysicist, Secretary, Smithsonian Institution, Washington, D. C.	1914
Adams, Edwin Plimpton, M.S., Ph.D., Sc.D. Professor of Physics, Princeton University, Princeton, N. J.	1915
Adams, James Truslow, A.M., LL.D., Litt.D., L.H.D. Author, American Historian. Sheffield House, Southport, Conn.	1938
Adams, Roger, A.B., A.M., Ph.D., Sc.D. Head of the Chemistry Department, University of Illinois. 603 Michigan Avenue, Urbana, Ill.	1935
Adams, Walter Sydney, A.M., Sc.D., LL.D. Astronomer, Director, Mount Wilson Observatory, Pasadena, Calif.	1915
Adler, Cyrus, M.A., Ph.D., D.H.L., Litt.D. Philologist and Orientalist, President, Dropsie College for Hebrew and Cognate Learning, Broad and York Streets, Philadelphia, Pa.	1900
Aitken, Robert Grant, A.M., Sc.D., LL.D. Astronomer, Director Emeritus, Lick Observatory. 1109 Spruce Street, Berkeley, Calif.	1919
Albright, William F., Ph.D., Litt.D., D.H.L., Th.D. Orientalist and Archaeologist, Professor of Semitic Languages, Johns Hopkins University, Baltimore, Md.	1929
Alexander, James W., A.M., Ph.D., A.A. Professor of Mathematics, Institute for Advanced Study. 29 Cleveland Lane, Princeton, N. J.	1928

	Date of Election
Allen, Charles Elmer, B.S., Ph.D. Professor of Botany, University of Wisconsin. 2014 Chamberlin Avenue, Madison, Wis.	1922
Anderson, Carl David, Ph.D. Associate Professor of Physics, California Institute of Technology, Pasadena, Calif.	1938
Andrews, Charles McLean, Ph.D., L.H.D., Litt.D., LL.D. Professor Emeritus of American History, Yale University. 424 St. Ronan Street, New Haven, Conn.	1924
Andrews, Donald Hatch, A.B., Ph.D. Chairman, Chemistry Department, Director, Chemistry Laboratory, Johns Hopkins University, Baltimore, Md.	1933
Andrews, Roy Chapman, M.A., Sc.D. Zoologist, Director, American Museum of Natural History, New York, N. Y.	1927
Angell, James Rowland, A.B., A.M., Ph.D., Litt.D., LL.D. Psychologist, President Emeritus, Yale University. 155 Blake Road, Hamden, Conn.	1924
Armstrong, Edward Cooke, A.B., Ph.D., LL.D., L.H.D. Professor of French Language, Princeton University. 26 Edgehill Street, Princeton, N. J.	1932
Arthur, Joseph Charles, Sc.D., LL.D. Professor Emeritus of Botany, Purdue University. 915 Columbia Street, Lafayette, Ind.	1919
Aydelotte, Frank, A.M., B.Litt., L.H.D., LL.D., D.Litt., D.C.L. Educator, President, Swarthmore College, Swarthmore, Pa.	1923
Baekeland, Leo H., D.Sc., D.Nat.Sc., D.Ch., D.Ap.Sc., LL.D. Chemist, President, Bakelite Corporation. 247 Park Avenue, New York, N. Y.	1935
Bailey, Irving Widmer, A.B., M.F., Sc.D. Professor of Plant Anatomy, Harvard University. 17 Buckingham Street, Cambridge, Mass.	1926

LIST OF MEMBERS

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Date of
Election

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|---|------|
| Bailey, Liberty Hyde, M.S., Litt.D., D.Sc., LL.D.
Botanist, Professor Emeritus of Horticulture,
Director, Bailey Hortorium, Cornell University,
Ithaca, N. Y. | 1896 |
| Bancroft, Wilder Dwight, A.B., Ph.D., Sc.D., LL.D.
Professor Emeritus of Physical Chemistry, Cornell
University. 7 East Avenue, Ithaca, N. Y. | 1920 |
| Barbour, Thomas, Ph.D., Sc.D.
Director, University Museum and Museum of Comparative
Zoology, Professor of Zoology, Harvard University.
278 Clarendon Street, Boston, Mass. | 1937 |
| Bartlett, Harley Harris, A.B.
Chairman, Department of Botany, Director, Botanical
Garden, University of Michigan. 538 Church Street,
Ann Arbor, Mich. | 1929 |
| Barton, George Aaron, A.M., Ph.D., S.T.D., LL.D.
Orientalist and Archaeologist, Professor Emeritus of
Semitic Languages, University of Pennsylvania.
131 Newton Street, Weston, Mass. | 1911 |
| Bateman, Harry, M.A., Ph.D.
Professor of Mathematics, Theoretical Physics and
Aeronautics, California Institute of Technology,
Pasadena, Calif. | 1924 |
| Beard, Charles Austin, LL.D., Ph.D.
Historian, Formerly Professor of Politics, Columbia
University. New Milford, Conn. | 1936 |
| Becker, Carl, Ph.D., Litt.D.
John Stambaugh Professor of History,
Cornell University, Ithaca, N. Y. | 1936 |
| Bell, Eric Temple, Ph.D.
Professor of Mathematics, California Institute
of Technology. 434 South Michigan Avenue, Pasadena,
Calif. | 1937 |
| Benedict, Francis Gano, Ph.D., Sc.D., M.D.
Physiologist, Director (ret.), Nutrition Laboratory,
Carnegie Institution of Washington (1907-37).
Machiasport, Maine. | 1910 |

	Date of Election
deBenneville, James S., A.B. Chemist. 907 West Roosevelt Boulevard, Philadelphia, Pa.	1897
Berkey, Charles Peter, B.S., M.S., Ph.D., Sc.D. Professor of Geology, Columbia University, New York, N. Y.	1928
Berry, Edward Wilber Professor of Paleontology, Dean, Johns Hopkins University, Baltimore, Md.	1919
Bigelow, Henry Bryant, Ph.D. Director, Woods Hole Oceanographic Institution; Professor of Zoology, Harvard University. Museum of Comparative Zoology, Cambridge, Mass.	1937
Birge, Edward Asahel, Ph.D., LL.D., Sc.D. Zoologist, President Emeritus, University of Wisconsin. 2011 Van Hise Avenue, Madison, Wis.	1923
Birkhoff, George David, A.M., Ph.D., Sc.D., D. (hon.) Perkins Professor of Mathematics, Harvard University. 984 Memorial Drive, Cambridge, Mass.	1921
Blakeslee, Albert F., A.M., Ph.D., D.Sc. Botanist, Director, Department of Genetics, Carnegie Institution of Washington, Cold Spring Harbor, Long Island, N. Y.	1924
Bliss, Gilbert Ames, B.S., M.S., Ph.D., Sc.D. Professor of Mathematics, Chairman, Department of Mathematics, University of Chicago, Chicago, Ill.	1926
Boas, Franz, Ph.D., M.D., LL.D., Sc.D. Professor Emeritus of Anthropology, Columbia University. Grantwood, Bergen County, N. J.	1935
Bogert, Marston Taylor, A.B., Ph.B., Sc.D., LL.D., R.N.D. Professor of Organic Chemistry, Columbia University, New York, N. Y.	1909
Bolton, Herbert Eugene, Ph.D., D.Litt., L.H.D., LL.D. Sather Professor of History, Chairman, Department of History, Director, Bancroft Library, University of California, Berkeley, Calif.	1937

LIST OF MEMBERS

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Date of
Election

- Bonner, Campbell, A.M., Ph.D.** 1938
Professor of the Greek Language and Literature,
University of Michigan. 1025 Martin Place, Ann Arbor,
Mich.
- Bowen, Norman L., M.A., B.Sc., Ph.D., Sc.D.** 1930
Geologist, Charles L. Hutchinson Distinguished Service
Professor of Petrology, University of Chicago, Chicago, Ill.
- Bowman, Isaiah, B.S., Ph.D., M.A., D.Sc., LL.D.** 1923
Geographer, President, Johns Hopkins University,
Baltimore, Md.
- Bridgman, Percy Williams, A.M., Ph.D., Sc.D.** 1916
Physicist, Hollis Professor of Mathematics and
Natural Philosophy, Harvard University.
Research Laboratory of Physics, Cambridge, Mass.
- Briggs, Lyman J., Ph.D., Sc.D., D.Eng., LL.D.** 1935
Physicist, Director, National Bureau of Standards.
3208 Newark Street, Cleveland Park, Washington, D. C.
- Bronk, Detlev W., M.S., Ph.D., Sc.D.** 1934
Physiologist, Johnson Professor of Biophysics, Director,
Eldridge Reeves Johnson Foundation for Medical
Physics, Director, Institute of Neurology, University of
Pennsylvania, Philadelphia, Pa.
- Brooke, C. F. Tucker, M.A., B.Litt., Litt.D.** 1938
Sterling Professor of English, Yale University.
88 Cold Spring Street, New Haven, Conn.
- Brubaker, Albert P., A.M., M.D., LL.D.** 1895
Professor Emeritus of Physiology, Jefferson Medical
College. 109 North 34th Street, Philadelphia, Pa.
- Bryant, William L.** 1935
Paleontologist, Director, Park Museum,
Providence, R. I.
- Buck, Carl Darling, A.B., Ph.D., Litt.D.** 1923
Professor Emeritus of Comparative Philology,
University of Chicago, Chicago, Ill.
- Buddington, Arthur F., Ph.B., M.S., Ph.D.** 1931
Professor of Geology, Chairman, Department of Geology,
Princeton University, Princeton, N. J.

	Date of Election
Bumpus, Hermon Carey, Ph.D., Sc.D., LL.D. Zoologist, Educator (ret.), Formerly Director, American Museum of Natural History. Duxbury, Mass.	1909
Bush, Vannevar, Sc.D., Eng.D. President, Carnegie Institution of Washington, Washington, D. C.	1937
Butler, Nicholas Murray, Ph.D., LL.D. President, Columbia University, New York, N. Y.	1938
Byrd, Richard Evelyn, D.Eng., Sc.D., LL.D. Geographer, Navigator, Rear-Admiral (ret.), United States Navy. 9 Brimmer Street, Boston, Mass.	1930
Calvert, Philip Powell, Ph.D. Professor of Zoology, University of Pennsylvania. P. O. Box 14, Cheyney, Pa.	1918
Campbell, Douglas Houghton, Ph.D., LL.D. Professor Emeritus of Botany, Stanford University, Calif.	1910
Cannon, Annie J., B.S., M.A., Sc.D., LL.D. Astronomer, Curator of Astronomical Photographs, Harvard College Observatory, Cambridge, Mass.	1925
Cannon, Walter Bradford, A.M., M.D., Sc.D., LL.D. George Higginson Professor of Physiology, Harvard Medical School, Boston, Mass.	1908
Capps, Edward, Ph.D., LL.D., Litt.D., L.H.D. Professor Emeritus of Classics, Princeton University, Princeton, N. J.	1920
Carlson, Anton Julius, A.M., Ph.D., M.D., LL.D. Professor of Physiology, University of Chicago. 5228 Greenwood Avenue, Chicago, Ill.	1928
Carpenter, Rhys, Ph.D. Professor of Archaeology, Bryn Mawr College. Jerry Run, R.D. 2, Downingtown, Pa.	1935
Carrel, Alexis, M.D., Sc.D., LL.D. Surgeon, Biologist, Rockefeller Institute for Medical Research, 66th Street and York Avenue, New York, N. Y.	1909

- Case, Ermine Cowles, A.B., A.M., M.S., Ph.D.** 1931
Chairman, Department of Geology, Director and Curator
of Vertebrates, Museum of Paleontology, University of
Michigan, Ann Arbor, Mich.
- Castle, William Ernest, A.M., Ph.D., Sc.D., LL.D.** 1910
Professor Emeritus of Genetics, Harvard University;
Research Associate in Genetics, University of California.
Hilgard Hall, Berkeley, Calif.
- Cather, Willa, Litt.D., LL.D.** 1934
Author. Care A. A. Knopf, 730 Fifth Avenue,
New York, N. Y.
- Cattell, James McKeen, Ph.D., LL.D., D.H.L., Sc.D.** 1888
Psychologist, Editor. Garrison, N. Y.
- Chapman, Frank Michler, Sc.D.** 1921
Curator in Ornithology, American Museum of
Natural History, New York, N. Y.
- Chase, George Henry, A.B., A.M., Ph.D., L.H.D.** 1929
Professor of Archaeology, Dean, Graduate School of
Arts and Sciences, Harvard University.
1 Bryant Street, Cambridge, Mass.
- Cheyney, Edward Potts, A.M., Litt.D., LL.D.** 1904
Professor Emeritus of European History, University of
Pennsylvania. R.F.D. 3, Media, Pa.
- Chinard, Gilbert, B.L., L.èsL., LL.D.** 1932
Professor of French Literature, Princeton University,
Princeton, N. J.
- Chittenden, Russell H., Ph.D., LL.D., Sc.D., M.D. (hon.)** 1904
Professor Emeritus of Physiological Chemistry, Director
Emeritus, Sheffield Scientific School, Yale University.
83 Trumbull Street, New Haven, Conn.
- Cleland, Ralph Erskine, A.B., M.S., Ph.D.** 1932
Professor and Head, Botany Department,
Indiana University, Bloomington, Ind.
- Cockerell, Theodore Dru Alison, D.Sc.** 1928
Professor Emeritus of Zoology, University of Colorado.
908 10th Street, Boulder, Colo.

	Date of Election
Coghill, George Ellett, Ph.D., Sc.D. Anatomist. Box 77A, R.F.D. 2, Gainesville, Fla.	1935
Commons, John Rogers, LL.D. Professor of Economics (ret.), University of Wisconsin, Madison, Wis.	1936
Compton, Arthur Holly, B.Sc., Ph.D., Sc.D., LL.D. Professor of Physics, University of Chicago. 5637 Woodlawn Avenue, Chicago, Ill.	1925
Compton, Karl Taylor, Ph.D., Sc.D., D.Eng., LL.D. Physicist, President, Massachusetts Institute of Technology, Cambridge, Mass.	1923
Conant, James Bryant, Ph.D., LL.D. Chemist, President, Harvard University. 17 Quincy Street, Cambridge, Mass.	1935
Conklin, Edwin Grant, Ph.D., Sc.D., LL.D. Professor Emeritus of Biology, Princeton University, Princeton, N. J.	1897
Cook, Gustavus Wynne, Sc.D. Investigator in Astronomical Science. Roslyn House, Wynnewood, Pa.	1934
Coolidge, William David, Ph.D., Sc.D. Physicist, Director, Research Laboratories of the General Electric Company. 1480 Lenox Road, Schenectady, N. Y.	1938
Corwin, Edward Samuel, Ph.D., LL.D., Litt.D. Professor of Jurisprudence, Princeton University, Princeton, N. J.	1936
Cottrell, Frederick Gardner, Ph.D. Consulting Chemist, Bureau of Chemistry and Soils, United States Department of Agriculture. 3904 Ingomar Street, N.W., Washington, D. C.	1938
Crawford, James Pyle Wickersham, A.B., Ph.D., Litt.D. Professor of Romance Languages, University of Pennsylvania. 4012 Pine Street, Philadelphia, Pa.	1929
Cret, Paul Philippe, Sc.D., N.A. Architect, Architects Building, Philadelphia, Pa.	1928

- Crew, Henry, Ph.D.** 1921
Professor Emeritus of Physics, Northwestern University.
620 Library Place, Evanston, Ill.
- Crile, George, A.M., M.D., LL.D.** 1912
Surgeon, Director, Cleveland Clinic Foundation,
Euclid Avenue at East 93rd Street, Cleveland, Ohio.
- Crocker, William, A.B., A.M., Ph.D.** 1931
Botanist, Director, Boyce Thompson Institute for
Plant Research. 1086 North Broadway, Yonkers, N. Y.
- Cross, Whitman, B.S., Ph.D., Sc.D.** 1915
Geologist, United States Geological Survey (ret.).
101 East Kirke Street, Chevy Chase, Md.
- Cross, Wilbur L., A.B., Ph.D., Litt.D., L.H.D., LL.D.** 1934
Governor of Connecticut (1932-38); Professor
Emeritus of English, Yale University.
24 Edgehill Road, New Haven, Conn.
- Curtis, Heber Doust, A.M., Ph.D., Sc.D.** 1920
Astronomer, Director, The Observatory, University of
Michigan, Ann Arbor, Mich.
- Cushing, Harvey, A.M., M.D., Sc.D., LL.D., Litt.D.** 1930
Consulting Neuro-Surgeon, Yale School of Medicine,
New Haven, Conn.
- Dahlgren, Ulric, A.B., M.S.** 1919
Professor of Biology, Princeton University,
Princeton, N. J.
- Daly, Reginald Aldworth, A.M., Ph.D., Sc.D.** 1913
Professor of Geology, Harvard University.
23 Hawthorn Street, Cambridge, Mass.
- Darrach, William, A.B., A.M., M.D., Sc.D., LL.D.** 1929
Professor of Clinical Surgery, Dean Emeritus of
the Medical Faculty, Columbia University.
180 Fort Washington Avenue, New York, N. Y.
- Darrow, Karl Kelchner, Ph.D.** 1936
Research Physicist, Bell Telephone Laboratories.
230 West 105th Street, New York, N. Y.
- Davenport, Charles Benedict, S.B., A.M., Ph.D.** 1907
Biologist, Research Associate, Carnegie Institution of
Washington, Cold Spring Harbor, Long Island, N. Y.

	Date of Election
Davis, Bradley Moore, A.M., Ph.D. Professor of Botany, University of Michigan, Ann Arbor, Mich.	1914
Davis, Harvey Nathaniel, Ph.D., Sc.D., LL.D., D.Eng. Mechanical Engineer, President, Stevens Institute of Technology. Hoxie House, Castle Point, Hoboken, N. J.	1935
Davis, John William, A.B., LL.B., LL.D. Lawyer, Solicitor General, United States Army (1913-18); United States Ambassador to Great Britain (1918-21). 15 Broad Street, New York, N. Y.	1923
Davisson, Clinton J., Ph.D., D.Sc. Physicist, Bell Telephone Laboratories. 463 West Street, New York, N. Y.	1929
Day, Arthur L., Ph.D., Sc.D. Geophysicist, Director (ret.), Geophysical Laboratory (1907-36), Carnegie Institution of Washington. 1565 Old Georgetown Road, Bethesda, Md.	1912
Day, Edmund Ezra, Ph.D., LL.D. President, Cornell University, Ithaca, N. Y.	1937
Delano, Frederic Adrian Administrator (ret.); Vice-chairman, National Resources Committee since 1933. 2400 16th Street, Washington, D. C.	1935
Dempster, Arthur Jeffrey, A.B., A.M., Ph.D. Professor of Physics, University of Chicago. 5757 Kenwood Avenue, Chicago, Ill.	1932
Derleth, Charles, Jr., C.E., LL.D. Engineer, Dean, College of Engineering, University of California, Berkeley, Calif.	1936
Dewey, John, Ph.D., LL.D. Professor of Philosophy, Columbia University, New York, N. Y.	1911
Dinsmoor, William Bell, Litt.D. Professor of Archaeology, Columbia University. 9 East 77th Street, New York, N. Y.	1933

LIST OF MEMBERS

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Date of
Election

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| Dodd, William Edward, Ph.D., LL.D.
United States Ambassador to Germany (1933-37);
Formerly Professor of American History, University
of Chicago. Round Hill, Va. | 1936 |
| Dodds, Harold Willis, Ph.D., LL.D.
Administrator, President, Princeton University,
Princeton, N. J. | 1935 |
| Dresden, Arnold, M.S., Ph.D.
Professor of Mathematics, Swarthmore College.
606 Elm Avenue, Swarthmore, Pa. | 1932 |
| Dugan, Raymond Smith, B.A., M.A., Ph.D.
Professor of Astronomy, Princeton University,
Princeton, N. J. | 1931 |
| Duggar, Benjamin Minge, A.M., Ph.D.
Professor of Physiologic and Economic Botany,
University of Wisconsin, Madison, Wis. | 1921 |
| Dunn, Gano, M.S., E.E.
Engineer, President, J. G. White Engineering
Corporation. 80 Broad Street, New York, N. Y. | 1924 |
| Du Pont, Francis I.
Chemist, E. I. du Pont de Nemours and Company.
P. O. Box 683, Wilmington, Del. | 1930 |
| Du Pont, Pierre Samuel, B.S.
Chemist, Manufacturer, E. I. du Pont de Nemours and
Company. Du Pont Building, Wilmington, Del. | 1917 |
| Durand, William Frederick, Ph.D., LL.D.
Professor Emeritus of Mechanical Engineering,
Stanford University, Calif. | 1917 |
| Edgerton, Franklin, Ph.D.
Professor of Sanskrit and Comparative Philology,
Yale University. 174 Blake Road, Hamden,
New Haven, Conn. | 1935 |
| Einstein, Albert, Ph.D., M.D.
Professor of Theoretical Physics, Institute for
Advanced Study, Princeton, N. J. | 1930 |
| Eisenhart, Luther Pfahler, A.B., Ph.D., Sc.D., LL.D.
Professor of Mathematics, Dean, Graduate School,
Princeton University. Wyman House, Princeton, N. J. | 1913 |

	Date of Election
Emmet, William LeRoy, Sc.D. Consulting Engineer, General Electric Company, Schenectady, N. Y.	1898
Erlanger, Joseph, B.S., M.D., LL.D., Sc.D. Professor of Physiology, Washington University. 5127 Waterman Avenue, St. Louis, Mo.	1927
Farrand, Livingston, A.M., M.D., LL.D. Educator, President Emeritus, Cornell University. Federal Hill Road, Brewster, N. Y.	1924
Farrand, Max, Ph.D., LL.D., L.H.D. Historian, Director, Huntington Library and Art Gallery, San Marino, Calif.	1928
Ferguson, William Scott, A.M., Ph.D., LL.D., Litt.D. Professor of Ancient and Modern History, Harvard University. 8 Scott Street, Cambridge, Mass.	1937
Fernald, Merritt Lyndon, S.B., D.C.L. Professor of Natural History, Director, Gray Herbarium, Harvard University, Cambridge, Mass.	1936
Fetter, Frank Albert, Ph.D., LL.D. Professor Emeritus of Political Economy, Princeton University. 168 Prospect Avenue, Princeton, N. J.	1935
Finley, John Huston, M.A., LL.D., L.H.D., J.U.D., Litt.D. Editor Emeritus, <i>The New York Times</i> , New York, N. Y.	1919
Fisher, Irving, A.B., Ph.D., LL.D. Professor of Political Economy, Yale University. 460 Prospect Street, New Haven, Conn.	1927
Flexner, Simon, M.D., Sc.D., LL.D. Pathologist, Director Emeritus, Rockefeller Institute for Medical Research, 66th Street and York Avenue, New York, N. Y.	1901
Foote, Paul Darwin, A.B., M.A., Ph.D. Physicist, Executive Vice-president, Gulf Research and Development Company. P.O. Drawer 2038, Pittsburgh, Pa.	1927
Forbes, Alexander, A.B., A.M., M.D. Professor of Physiology, Harvard Medical School, Shattuck Street, Boston, Mass.	1931

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| Ford, Worthington Chauncey, A.M., Litt.D., LL.D.
Historian, Statistician. 11 bis Rue Henri Cloppet,
Le Vésinet, S. et O., France. | 1922 |
| Fosdick, Raymond Blaine, B.A., M.A., LL.B., LL.D.
Lawyer, President, Rockefeller Foundation and
General Education Board, 49 West 49th Street,
New York, N. Y. | 1930 |
| Fox, Dixon Ryan, Ph.D., Pd.D., L.H.D., Litt.D., LL.D.,
D.C.L.
Historian, President, Union College, Schenectady, N. Y. | 1935 |
| Fox, Herbert, A.B., M.D.
Professor of Comparative Pathology, University of
Pennsylvania; Director, William Pepper Laboratory,
Hospital of the University of Pennsylvania,
Philadelphia, Pa. | 1932 |
| Franck, James, Ph.D., LL.D.
Professor of Physical Chemistry,
University of Chicago, Chicago, Ill. | 1937 |
| †Frank, Tenney, Ph.D.
Professor of Latin, Johns Hopkins University.
110 Elmhurst Road, Roland Park, Baltimore, Md. | 1927 |
| Frost, Robert, L.H.D., Litt.D.
Poet, Professor of English, Amherst College.
South Shaftsbury, Vt. | 1937 |
| Gaposchkin, Cecilia Payne, B.A., Ph.D.
Astronomer, Harvard College Observatory,
Cambridge, Mass. | 1936 |
| Gasser, Herbert Spencer, A.M., M.D., Sc.D.
Physiologist, Director, Rockefeller Institute for
Medical Research, 66th Street and York Avenue,
New York, N. Y. | 1937 |
| Gates, Thomas Sovereign, Ph.B., LL.B., LL.D.
Administrator, President, University of Pennsylvania,
Philadelphia, Pa. | 1930 |
| Gay, Edwin Francis, A.B., Ph.D., Litt.D., LL.D.
Professor Emeritus of Economic History, Harvard
University. 2040 Pasqual Street, Pasadena, Calif. | 1932 |

† Deceased April 3, 1939.

	Date of Election
†Gest, William Purves, A.B., A.M., LL.B., LL.D. Lawyer, Chairman of the Board, Fidelity-Philadelphia Trust Company. Merion, Pa.	1926
Gies, William J., B.S., Ph.B., M.S., Ph.D., Sc.D., LL.D. Professor of Biological Chemistry, Columbia University Medical School. 630 West 168th Street, New York, N. Y.	1915
Gifford, Walter Sherman, A.B., LL.D., D.Sc. Administrator, President, American Telephone and Telegraph Company. 195 Broadway, New York, N. Y.	1931
Gomberg, Moses, B.S., Sc.D., LL.D. Professor Emeritus of Chemistry, University of Michigan. 712 Onondaga Street, Ann Arbor, Mich.	1920
Goodrich, Herbert Funk, A.B., LL.B., LL.D. Dean, Law School, Professor of Law, Vice-president, University of Pennsylvania. 7701 Cresheim Road, Chestnut Hill, Philadelphia, Pa.	1937
Goodspeed, Arthur Willis, A.B., Ph.D. Professor Emeritus of Physics, University of Pennsylvania. 4623 Sansom Street, Philadelphia, Pa.	1896
Grandgent, Charles Hall, A.B., L.H.D., Litt.D. Professor Emeritus of Romance Languages, Harvard University. 107 Walker Street, Cambridge, Mass.	1929
Graves, Frank Pierrepont, A.M., Ph.D., Litt.D., L.H.D., LL.D., D.C.L. Educator, President, University of the State of New York, Commissioner of Education. State Education Building, Albany, N. Y.	1927
Greene, Evarts B., Ph.D., Litt.D., L.H.D., LL.D. Professor of American History, Columbia University, New York, N. Y.	1931
Gregory, Herbert Ernest, Ph.D., D.Sc. Silliman Professor Emeritus of Geology, Yale University; Director Emeritus, Bernice P. Bishop Museum, Honolulu, Hawaii.	1923

† Deceased January 12, 1938.

LIST OF MEMBERS

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Date of
Election

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|---|------|
| Gregory, William King, A.M., Ph.D.
Professor of Vertebrate Paleontology, Columbia
University; Curator, Department of Comparative
Anatomy, Department of Ichthyology, American
Museum of Natural History, New York, N. Y. | 1925 |
| Griffith, J. P. Crozer, A.B., M.D., Ph.D.
Physician, Professor of Pediatrics, University of
Pennsylvania. 1810 Spruce Street, Philadelphia, Pa. | 1907 |
| Guggenheim, William, B.S.
Industrialist, Administrator, Philanthropist.
3 Riverside Drive, New York, N. Y. | 1930 |
| Haney, John Louis, A.B., A.M., B.S., Ph.D.
Educator, President, Central High School of Philadelphia.
6419 Woodbine Avenue, Overbrook, Philadelphia, Pa. | 1929 |
| Harkins, William Draper, A.B., Ph.D.
Professor of Physical Chemistry, University of
Chicago. 5437 Ellis Avenue, Chicago, Ill. | 1925 |
| Harkness, Edward S., A.B., M.A., LL.D.
Administrator, Philanthropist. 654 Madison Avenue,
New York, N. Y. | 1934 |
| Harper, Robert A., M.A., Ph.D., D.Sc.
Professor Emeritus of Botany, Columbia University,
New York, N. Y. | 1909 |
| Harrison, Ross G., M.A., Ph.D., M.D., Sc.D.
Professor Emeritus of Biology, Yale University;
Chairman, National Research Council.
142 Huntington Street, New Haven, Conn. | 1913 |
| Harvey, E. Newton, Ph.D.
Henry Fairfield Osborn Professor of Biology, Princeton
University, Princeton, N. J. | 1929 |
| Hawk, Philip Bovier, M.S., Ph.D.
Chemist, President and Director, Food Research
Laboratories, Inc., of New York. 114 East 32nd Street,
New York, N. Y. | 1915 |
| Hayward, Nathan, A.B., S.B.
President (ret.), The Franklin Institute.
12 South Twelfth Street, Philadelphia, Pa. | 1937 |

	Date of Election
Hazen, Charles D., A.B., Ph.D., L.H.D., Litt.D. Professor of History, Columbia University, New York, N. Y.	1923
Heiser, Victor George, M.D., A.B., Sc.D. Physician, President, International Leprosy Association. Room 410, Metropolitan Tower, New York, N. Y.	1918
Henderson, Lawrence J., M.D., Sc.D. Professor of Biological Chemistry, Harvard University. 4 Willard Street, Cambridge, Mass.	1921
Henderson, Robert, B.A., D.Sc. Mathematician, Actuarial Consultant. Crown Point, Essex County, N. Y.	1927
Henderson, Yandell, Ph.D. Professor of Applied Physiology, Yale University. 440 Prospect Street, New Haven, Conn.	1935
Hendrickson, George Lincoln, A.B., L.H.D., A.M., LL.D. Professor of Greek and Latin Literature, Yale University, New Haven, Conn.	1932
Hobbs, William Herbert, A.M., Ph.D., D.Eng. Professor Emeritus of Geology, University of Michigan, Ann Arbor, Mich.	1909
Holland, Leicester Bodine, B.S., M.A., Ph.D., F.A.I.A. Archaeologist, Professor of Fine Arts, University of Pennsylvania; Chief, Division of Fine Arts, Library of Congress. 4203 Pine Street, Philadelphia, Pa.	1931
Hooton, Earnest A., B.A., M.A., Ph.D., B.Litt., Sc.D. Professor of Anthropology, Curator of Somatology, Peabody Museum, Harvard University, Cambridge, Mass.	1931
Hoover, Herbert, Dr. Eng., M.D., Sc.D., LL.D., D.C.L., J.D. Engineer, Thirty-first President of the United States. Stanford University, Calif.	1918
Hopkins, B Smith, Ph.D., D.Sc. Professor of Inorganic Chemistry, University of Illinois, Urbana, Ill.	1927

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Date of
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| Hopkinson, Edward, Jr., A.B., LL.B.
Lawyer, Banker, Trustee, University of Pennsylvania.
8700 Montgomery Avenue, Chestnut Hill,
Philadelphia, Pa. | 1938 |
| Howard, Leland Ossian, M.D., Ph.D., Sc.D., LL.D.
Zoologist, Consulting Entomologist, United States
Public Health Service. Bureau of Entomology,
United States Department of Agriculture,
Washington, D. C. | 1911 |
| Howell, William Henry, A.B., Ph.D., M.D., Sc.D., LL.D.
Professor Emeritus of Physiology, Formerly Dean,
Medical Faculty and Director, School of Hygiene,
Johns Hopkins University. 112 St. Dunstan's Road,
Baltimore, Md. | 1903 |
| Hrdlička, Aleš, M.D., Sc.D.
Curator, Division of Physical Anthropology,
United States National Museum, Washington, D. C. | 1918 |
| Hubble, Edwin P., B.Sc., Ph.D., B.A., D.Sc., LL.D.
Astronomer, Mount Wilson Observatory, Pasadena, Calif. | 1929 |
| Huebner, Solomon Stephen, B.L., M.L., Ph.D., Sc.D.
Economist, Professor of Insurance and Commerce,
University of Pennsylvania. 697 South Highland Avenue,
Merion, Pa. | 1930 |
| Hughes, Charles Evans, A.B., A.M., LL.B., LL.D., D.C.L.
Chief Justice of the United States.
2223 R Street, N.W., Washington, D. C. | 1926 |
| Hulett, George A., A.B., Ph.D.
Professor Emeritus of Physical Chemistry, Princeton
University. 44 Washington Road, Princeton, N. J. | 1913 |
| Humphreys, William Jackson, A.B., C.E., Ph.D.
Professor Emeritus of Meteorological Physics,
George Washington University; Collaborator,
United States Weather Bureau, Washington, D. C. | 1929 |
| Huntington, Edward Vermilye, A.B., A.M., Ph.D., Sc.D.
Mathematician, Professor of Mechanics, Harvard
University. 48 Highland Street, Cambridge, Mass. | 1933 |

	Date of Election
Ives, Herbert E., B.S., Ph.D., Sc.D. Physicist, Bell Telephone Laboratories. 32 Laurel Place, Montclair, N. J.	1917
Jackson, Dugald Caleb, C.E., D.Sc., D.Eng. Professor Emeritus of Electrical Engineering, Massachusetts Institute of Technology. 5 Mercer Circle, Cambridge, Mass.	1931
Jacobs, Merkel Henry, A.B., Ph.D. Professor of Physiology, University of Pennsylvania, Philadelphia, Pa.	1930
Jayne, Horace Howard Furness, A.B., A.M. Archaeologist, Chief Division of Eastern Art, Pennsylvania Museum; Director, University Museum, University of Pennsylvania. Wallingford, Pa.	1934
Jenks, John Story Banker, Trustee, President, University Museum, University of Pennsylvania. 123 South Broad Street, Philadelphia, Pa.	1936
Jennings, Herbert S., Ph.D., Sc.D., LL.D. Professor Emeritus of Zoology, Johns Hopkins University, Baltimore, Md.	1907
Jewett, Frank Baldwin, Ph.D., D.Sc., D.Eng., LL.D. Vice-president, American Telephone and Telegraph Company; President, Bell Telephone Laboratories. 195 Broadway, New York, N. Y.	1938
Johnson, Douglas, Ph.D., D.Sc. Geologist and Geographer, Professor of Physiography, Columbia University, New York, N. Y.	1920
Johnson, Eldridge Reeves, A.E.D. Industrialist, Founder, Victor Talking Machine Company. 608 West Jersey Trust Building, Camden, N. J.	1928
Johnson, Emory R., Litt.M., Ph.D., Sc.D. Professor of Transportation and Commerce, Logan Hall, University of Pennsylvania, Philadelphia, Pa.	1915
Jones, Lewis Ralph, Ph.B., Ph.D., Sc.D., LL.D. Professor of Plant Pathology, University of Wisconsin. 146 North Prospect Avenue, Madison, Wis.	1925

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| Joslin, Elliott Proctor, B.A., M.A., Ph.B., M.D.
Physician, Clinical Professor Emeritus of Medicine,
Harvard Medical School. 81 Bay State Road,
Boston, Mass. | 1925 |
| Kemmerer, Edwin Walter, A.B., Ph.D., LL.D., D.C.S.,
D.Sc., Hon.D.
Walker Professor of International Finance,
Princeton University, Princeton, N. J. | 1932 |
| Kennelly, Arthur Edwin, A.M., Sc.D., D.Eng.
Professor Emeritus of Electrical Engineering,
Harvard University and Massachusetts Institute
of Technology, Cambridge, Mass. | 1896 |
| Keppel, Frederick Paul, Litt.D., LL.D.
President, Carnegie Corporation of New York,
522 Fifth Avenue, New York, N. Y. | 1938 |
| Kettering, Charles Franklin, M.E., E.E., D.Eng., D.Sc.
Research Engineer, Vice-president, General Motors
Corporation; General Director, Research Laboratories
Division, General Motors Corporation.
Ridgeleigh Terrace, Dayton, Ohio. | 1930 |
| Keyes, Frederick George, M.S., Ph.D., D.Sc.
Professor and Head, Department of Chemistry,
Massachusetts Institute of Technology.
15 Berkeley Street, Cambridge, Mass. | 1938 |
| Kidder, Alfred Vincent, Ph.D., LL.D.
Archaeologist, Chairman, Division of Historical
Research, Carnegie Institution of Washington.
10 Frisbie Place, Cambridge, Mass. | 1934 |
| Kofoid, Charles A., A.M., Ph.D., Sc.D., LL.D.
Professor Emeritus of Zoology, University of California,
Berkeley, Calif. | 1924 |
| Lamb, Arthur Becket, Ph.D., D.Sc.
Professor of Chemistry, Harvard University.
12 Oxford Street, Cambridge Mass. | 1936 |
| Lamont, Thomas William, A.B., LL.D.
Banker, Trustee. 23 Wall Street, New York, N. Y. | 1932 |
| Lampland, Carl O., A.B., A.M., LL.D.
Astronomer, Lowell Observatory, Flagstaff, Ariz. | 1931 |

	Date of Election
Lancaster, Henry Carrington, M.A., Ph.D. Professor of French Literature, Chairman, Department of Romance Languages, Johns Hopkins University. 604 Edgevale Road, Baltimore, Md.	1938
Landsteiner, Karl, M.D., D.Sc. Pathologist, Rockefeller Institute for Medical Research. 25 East 86th Street, New York, N. Y.	1935
Langmuir, Irving, M.A., Ph.D., Sc.D., LL.D. Chemist and Physicist, Associate Director, Research Laboratory, General Electric Company, Schenectady, N. Y.	1922
Lanman, Charles R., A.B., Ph.D., LL.D. Professor Emeritus of Sanskrit, Harvard University. 9 Farrar Street, Cambridge, Mass.	1906
Lashley, Karl Spencer, M.S., Ph.D., Sc.D. Research Professor of Neuropsychology, Harvard University, Cambridge, Mass.	1938
Lawrence, Ernest Orlando, B.S., A.M., Ph.D., Sc.D. Professor of Physics, Director, Radiation Laboratory, University of California, Berkeley, Calif.	1937
Lawson, Andrew Cowper, M.A., Ph.D., Sc.D., LL.D. Professor of Mineralogy and Geology (ret.), University of California, Berkeley, Calif.	1925
Lefschetz, Solomon, M.E., Ph.D. Research Professor of Mathematics, Princeton University. 129 Broadmead, Princeton, N. J.	1929
Leith, Charles Kenneth, B.S., Ph.D., LL.D., D.Sc. Professor of Geology, University of Wisconsin. Moraine, Old Sauk Road, Madison, Wis.	1926
Leland, Waldo G., A.B., A.M., Litt.D. Historian, Permanent Secretary, American Council of Learned Societies. 907 Fifteenth Street, Washington, D. C.	1931
Leuschner, Armin Otto, A.B., Ph.D., Sc.D. Professor of Astronomy, Chairman, Department of Astronomy, University of California. 1816 Scenic Avenue, Berkeley, Calif.	1924

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Date of
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| Levene, Phoebus A., M.D.
Chemist, Rockefeller Institute for Medical Research.
129 East 82nd Street, New York, N. Y. | 1923 |
| Leverett, Frank, B.Sc., Sc.D.
Geologist (ret.), United States Geological Survey.
1724 South University Avenue, Ann Arbor, Mich. | 1924 |
| Lewis, Gilbert Newton, A.B., A.M., Ph.D., D.Sc.
Professor of Chemistry, Dean, College of Chemistry,
University of California, Berkeley, Calif. | 1918 |
| Lillie, Frank Ratray, B.A., Ph.D., Sc.D.
Andrew MacLeish Distinguished Service Professor
Emeritus of Embryology, University of Chicago.
5801 Kenwood Avenue, Chicago, Ill. | 1916 |
| Lillie, Ralph Stayner, B.A., Ph.D., Sc.D.
Professor of General Physiology, University of Chicago.
5545 Kenwood Avenue, Chicago, Ill. | 1937 |
| Lindgren, Waldemar, M.E., Sc.D.
Professor Emeritus of Geology, Massachusetts
Institute of Technology, Cambridge, Mass. | 1917 |
| Lingelbach, William E., B.A., Ph.D.
Professor of Modern European History, University of
Pennsylvania. 4304 Osage Avenue, Philadelphia, Pa. | 1916 |
| Lippincott, J. Bertram
Publisher, Chairman of the Board, J. B. Lippincott
Company. 1712 Spruce Street, Philadelphia, Pa. | 1921 |
| Livingston, Burton E., B.S., Ph.D.
Professor of Plant Physiology and Forest Ecology,
Director, Laboratory of Plant Physiology,
Johns Hopkins University, Baltimore, Md. | 1933 |
| Loeb, Leo, M.D.
Professor Emeritus of Pathology, Washington University
Medical School, St. Louis, Mo. | 1910 |
| Loomis, Alfred Lee, A.B., LL.B., D.Sc., M.Sc.
Physicist, Director, Loomis Laboratories.
Tuxedo Park, N. Y. | 1930 |

	Date of Election
Lovejoy, Arthur Oncken, A.B., A.M., LL.D. Professor of Philosophy, Johns Hopkins University. 827 Park Avenue, Baltimore, Md.	1932
Lovett, Edgar Odell, Ph.D., Sc.D., LL.D. Mathematician and Astronomer, President, The Rice Institute, Houston, Texas.	1904
Lowell, Abbott Lawrence, A.B., LL.B., Ph.D., Litt.D., LL.D. President Emeritus, Harvard University. 171 Marlborough Street, Boston, Mass.	1909
Lowes, John Livingston, Ph.D., LL.D., Litt.D., L.H.D. Francis Lee Higginson Professor of English Literature, Harvard University. 984 Memorial Drive, Cambridge, Mass.	1934
Lyman, Theodore, A.M., Ph.D. Professor Emeritus of Physics, Director, Jefferson Laboratory, Harvard University, Cambridge, Mass.	1918
McClung, Clarence E., A.M., Ph.D. Professor of Zoology, Director, Zoological Laboratory, University of Pennsylvania, Philadelphia, Pa.	1913
McClure, Charles Freeman Williams, A.M., Sc.D. Professor Emeritus of Comparative Anatomy, Princeton University, Princeton, N. J.	1897
MacCurdy, George Grant, Ph.D. Professor Emeritus of Anthropology, Yale University; Director, American School of Prehistoric Research, Old Lyme, Conn.	1925
McDaniel, Walton Brooks, A.B., A.M., Ph.D. Professor Emeritus of Latin Language and Literature, University of Pennsylvania. 4082 Malaga Avenue, Coconut Grove, Fla.	1917
MacDougal, Daniel Trembly, M.A., Ph.D., LL.D. Botanist, Research Associate (ret.), Carnegie Institution of Washington. Carmel, Calif.	1916
Macfarlane, John Muirhead, B.S., Sc.D., LL.D., Litt.D. Professor Emeritus of Botany, University of Pennsylvania. 427 West Hansberry Street, Germantown, Philadelphia, Pa.	1892

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|---|------|
| McGregor, James Howard, B.S., M.A., Ph.D.
Professor of Zoology, Columbia University,
New York, N. Y. | 1929 |
| McIlwain, Charles Howard, A.M., Ph.D., LL.D.
Eaton Professor of the Science of Government, Harvard
University. 48 Village Hill Road, Belmont, Mass. | 1938 |
| Magie, William Francis, A.M., Ph.D., LL.D., D.Sc.
Professor Emeritus of Physics, Princeton University.
118 Library Place, Princeton, N. J. | 1896 |
| Manly, John Matthews, A.M., Ph.D., LL.D., Litt.D.
Professor Emeritus of English, University of Chicago.
6030 Kimbark Avenue, Chicago, Ill. | 1912 |
| Mark, Edward Laurens, A.M., Ph.D., LL.D.
Professor Emeritus of Anatomy, Harvard University.
109 Irving Street, Cambridge, Mass. | 1907 |
| Mason, William Smith, Ph.B., A.M., L.H.D., D.Litt.
Man of Affairs, Collector of Frankliniana, University
Trustee. 1401 Ridge Avenue, Evanston, Ill. | 1928 |
| Matthews, Albert, A.B.
Modern Philologist and Historian.
19 St. Botolph Street, Boston, Mass. | 1899 |
| Mees, Charles Edward Kenneth, D.Sc.
Physicist, Vice-president in Charge of Research
and Development, Eastman Kodak Company,
Rochester, N. Y. | 1937 |
| Meritt, Benjamin Dean, Ph.D., D.Litt., LL.D.
Professor of Greek Epigraphy, Institute for Advanced
Study, Princeton, N. J. | 1938 |
| Merriam, Charles Edward, Ph.D., LL.D.
Professor of Political Science, University of Chicago.
6041 University Avenue, Chicago, Ill. | 1935 |
| Merriam, John C., B.S., Ph.D., Sc.D., LL.D.
Paleontologist, President Emeritus, Carnegie Institution
of Washington, Washington, D. C. | 1914 |
| Merrill, Elmer Drew, B.S., M.S., Sc.D., LL.D.
Professor of Botany, Administrator of Botanical
Collections, Harvard University. Arnold Arboretum,
Jamaica Plain, Mass. | 1932 |

	Date of Election
Miller, Dayton Clarence, A.M., Sc.D., LL.D., D.Eng. Professor Emeritus of Physics, Case School of Applied Science, Cleveland, Ohio.	1919
Miller, Gerrit Smith, Jr., A.B. Zoologist, Curator of Mammals, United States National Museum, Washington, D. C.	1927
Miller, Hunter, LL.B., D.C.L. International Law, Historical Adviser, Department of State. Craigsland, R. M. D. 1, Victoria, B. C., Canada.	1928
Miller, John Anthony, A.M., Ph.D., LL.D. Professor Emeritus of Astronomy, Director, Sproul Observatory, Swarthmore College. Wallingford, Pa.	1915
Millikan, Robert Andrews, A.B., Ph.D., Sc.D., LL.D. Director, Norman Bridge Laboratory of Physics, Chairman, Executive Council, California Institute of Technology, Pasadena, Calif.	1914
Minot, George Richards, A.B., M.D., S.D. Professor of Medicine, Harvard University; Director, Thorndike Memorial Laboratory, and Visiting Physician, Boston City Hospital, Boston, Mass.	1935
Mitchell, Howard Hawks, Ph.D. Professor of Mathematics, University of Pennsylvania. 416 Sycamore Avenue, Merion, Pa.	1925
Mitchell, Samuel Alfred, Ph.D., LL.D. Professor of Astronomy, Director, Leander McCormick Observatory, University of Virginia, University, Va.	1923
Mitchell, Wesley Clair, A.B., Ph.D., LL.D., D.Litt. Professor of Economics, Columbia University; Director of Research, National Bureau of Economic Research. 161 West Twelfth Street, New York, N. Y.	1931
Montgomery, James Alan, A.B., Ph.D., S.T.D. Philologist, Formerly Director and President, American Schools of Oriental Research; Professor Emeritus of Hebrew, Graduate School, University of Pennsylvania. 6806 Greene Street, Germantown, Philadelphia, Pa.	1925
Moore, George Thomas, A.M., Ph.D. Botanist, Director, Missouri Botanical Garden, St. Louis, Mo.	1905

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Date of
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|--|------|
| Moore, J. Percy, Ph.D.
Professor of Zoology, University of Pennsylvania,
Philadelphia, Pa. | 1918 |
| Moore, John Bassett, LL.D.
International Law, Diplomatist, Judge, Permanent
Court of International Justice (1921-28).
960 Park Avenue, New York, N. Y. | 1907 |
| Morey, Charles Rufus, A.M., L.H.D. Litt.D.
Marquand Professor of Art and Archaeology, Princeton
University, Princeton, N. J. | 1938 |
| Morgan, Marshall S., A.B.
President, Fidelity-Philadelphia Trust Company.
R.F.D. 2, Malvern, Pa. | 1933 |
| Morgan, Thomas Hunt, B.S., Ph.D., D.Sc., LL.D.
Zoologist, Director, Kerckhoff Laboratories of Biological
Sciences, California Institute of Technology,
Pasadena, Calif. | 1915 |
| Morison, Samuel Eliot, Ph.D., M.A., Litt.D.
Professor of History, Harvard University.
Harvard College Library 417, Cambridge, Mass. | 1937 |
| Morris, Harrison Smith
Author, Formerly Director, Pennsylvania Academy of
the Fine Arts. Oak Lane Post Office, Philadelphia, Pa. | 1899 |
| Morris, Lawrence J., A.B.
Man of Affairs, Secretary, Pennsylvania Hospital.
240 South 4th Street, Philadelphia, Pa. | 1936 |
| Morris, Roland S., A.B., LL.B., LL.D., D.C.L., L.H.D.
Lawyer, Diplomatist, Professor of International Law,
University of Pennsylvania; United States Ambassador
to Japan (1917-21). 1617 Land Title Building,
Philadelphia, Pa. | 1922 |
| Morse, Marston, Ph.D., Sc.D.
Professor of Mathematics, Institute for Advanced Study,
Princeton, N. J. | 1936 |

	Date of Election
Moulton, Forest Ray, A.B., Ph.D., Sc.D. Astronomer, Permanent Secretary, American Association for the Advancement of Science. Smithsonian Institution Building, Washington, D. C.	1916
Moulton, Harold Glenn, Ph.D., LL.D. Economist, President, The Brookings Institution, 722 Jackson Place, N. W., Washington, D. C.	1938
Murlin, John Raymond, B.S., A.M., Ph.D., Sc.D. Professor of Physiology, Director, Department of Vital Economics, University of Rochester, 260 Crittenden Boulevard, Rochester, N. Y.	1932
Nitze, William Albert, Ph.D., L.H.D. Professor of Romance Languages and Literatures, University of Chicago, Chicago, Ill.	1936
Noble, G. Kingsley, Ph.D. Zoologist, Curator of Herpetology and of Experimental Biology, American Museum of Natural History, New York, N. Y.	1933
Norris, George Washington Banker, Formerly Governor, Philadelphia Federal Reserve Bank. Land Title Building, Philadelphia, Pa.	1937
Norris, George William, B.A., M.D. Physician, Author, Chief, Medical Service "A," Pennsylvania Hospital. Dimock, Susquehanna County, Pa.	1922
Northrop, John Howard, M.A., Ph.D., D.Sc. Biochemist, Rockefeller Institute for Medical Research, Princeton, N. J.	1938
Novy, Frederick G., Sc.D., M.D., LL.D. Dean Emeritus, Medical School, Professor Emeritus of Bacteriology, University of Michigan, Ann Arbor, Mich.	1934
Noyes, William Albert, A.B., B.S., Ph.D., LL.D., Chem.D., D.Sc. Professor Emeritus of Chemistry, University of Illinois, Urbana, Ill.	1914
Olivier, Charles P., M.A., Ph.D. Professor of Astronomy, University of Pennsylvania; Director, Flower Observatory, Upper Darby, Pa.	1932

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Date of
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|--|------|
| O'Neill, Eugene Gladstone, Litt.D.
Author, Playwright. Danville, Contra Costa County, Calif. | 1935 |
| Osgood, William Fogg, A.M., Ph.D., LL.D.
Professor Emeritus of Mathematics, Harvard University.
10 Dorset Road, Belmont, Mass. | 1915 |
| Osterhout, Winthrop John Vanleuven, A.M., Ph.D., Sc.D.
Physiologist, Rockefeller Institute for Medical Research,
66th Street and York Avenue, New York, N. Y. | 1917 |
| Packard, Francis Randolph, M.D.
Physician, Author. 304 South 19th Street,
Philadelphia, Pa. | 1933 |
| Parker, George Howard, Sc.D.
Professor Emeritus of Zoology, Harvard University.
16 Berkeley Street, Cambridge, Mass. | 1911 |
| Paton, Stewart, M.A., M.D.
Psychiatrist, Author. Sugar Hill, Franconia, R. F. D.,
N. H. | 1914 |
| Patterson, Ernest Minor, A.B., A.M., Ph.D., LL.D.
Professor of Economics, University of Pennsylvania.
404 South 47th Street, Philadelphia, Pa. | 1932 |
| Patterson, Lamar Gray
Chemist. Perdido Beach, Ala. | 1898 |
| Paul, J. Rodman, A.M.
Lawyer. 1830 Land Title Building, Philadelphia, Pa. | 1899 |
| Pauling, Linus Carl, Ph.D., Sc.D.
Professor of Chemistry, Chairman, Division of Chemistry
and Chemical Engineering, Director, Gates and Crellin
Laboratories of Chemistry, California Institute of
Technology, Pasadena, Calif. | 1936 |
| Pearl, Raymond, Ph.D., Sc.D., LL.D., Litt.D.
Professor of Biology, Johns Hopkins School of Hygiene
and School of Medicine. 1901 East Madison Street,
Baltimore, Md. | 1915 |
| Pender, Harold, A.B., Ph.D., Sc.D.
Consulting Engineer, Dean, Moore School of
Electrical Engineering, University of Pennsylvania,
Philadelphia, Pa. | 1917 |

	Date of Election
Penniman, Josiah Harmar, A.B., Ph.D., LL.D., Litt.D., L.H.D.	1901
Professor of English Literature, Provost, University of Pennsylvania, Philadelphia, Pa.	
Pepper, George Wharton, B.A., LL.B., LL.D., D.C.L.	1897
Lawyer, United States Senator (1922-27); Formerly Professor of Law, University of Pennsylvania. 2231 Land Title Building, Philadelphia, Pa.	
Pepper, William, A.B., M.D., Sc.D.	1937
Dean, School of Medicine, University of Pennsylvania. Prospect Avenue, Melrose Park, Philadelphia, Pa.	
Phelps, William Lyon, Ph.D., Litt.D., L.H.D., LL.D., D.D., D.S.T.	1927
Author, Professor Emeritus of English Literature, Yale University. 110 Whitney Avenue, New Haven, Conn.	
Prince, John Dyneley, B.A., Ph.D.	1913
Orientalist and Comparative Philologist, Professor of East European Languages, Columbia University, New York, N. Y.	
Putnam, Herbert, Litt.D., LL.D.	1937
Librarian of Congress, Washington, D. C.	
Rand, Edward Kennard, A.B., A.M., Ph.D., Litt.D., LL.D.	1925
Professor of Latin, Harvard University. 107 Lake View Avenue, Cambridge, Mass.	
Ravenel, Mazÿck P., M.D.	1901
Physician, Editor-in-Chief, American Journal of Public Health, University of Missouri, Columbia, Mo.	
Read, Conyers, A.B., Ph.D., B.Litt., Litt.D.	1934
Professor of English History, University of Pennsylvania. 226 South 16th Street, Philadelphia, Pa.	
Reese, Charles Lee, Ph.D., Sc.D.	1922
Chemist, Director, E. I. du Pont de Nemours & Company. 1600 Brinckle Avenue, Wilmington, Del.	
Reeves, Jesse S., Ph.D., L.H.D., LL.D.	1934
Professor of Political Science, University of Michigan. 1945 Cambridge Road, Ann Arbor, Mich.	
Reid, Harry Fielding, C.E., A.B., Ph.D.	1910
Professor Emeritus of Dynamical Geology and Geography, Johns Hopkins University, Baltimore, Md.	

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| Repplier, Agnes, Litt.D.
Author. 920 Clinton Street, Philadelphia, Pa. | 1928 |
| Rhoads, Charles James, A.B.
Banker (ret.), Trustee, Bryn Mawr College,
Haverford College. Bryn Mawr, Pa. | 1921 |
| Richards, Alfred Newton, Ph.D., Sc.D., M.D., LL.D.
Professor of Pharmacology, University of Pennsylvania.
6 Rugby Road, Bryn Mawr, Pa. | 1935 |
| Richards, Horace Clark, A.B., Ph.D.
Professor Emeritus of Mathematical Physics,
University of Pennsylvania.
509 Woodland Terrace, Philadelphia, Pa. | 1907 |
| Richtmyer, Floyd K., Ph.D.
Professor of Physics, Dean, Graduate School,
Cornell University, Ithaca, N. Y. | 1935 |
| Riddle, Oscar, A.B., Ph.D., LL.D.
Physiologist, Carnegie Station for Experimental
Evolution, Cold Spring Harbor, Long Island, N. Y. | 1926 |
| Roberts, Owen J., A.B., LL.B., LL.D., D.C.L.
Associate Justice, Supreme Court of the United States,
Washington, D. C. | 1934 |
| Robinson, David Moore, Ph.D., LL.D., L.H.D., Litt.D.
Professor of Archaeology and Epigraphy, Lecturer in
Greek Literature, Johns Hopkins University,
Baltimore, Md. | 1936 |
| Rockefeller, John D., Jr., A.B., A.M.
Administrator, Trustee, Rockefeller Institute for Medical
Research; Chairman of the Board, Rockefeller
Foundation. 30 Rockefeller Plaza, New York, N. Y. | 1931 |
| Rolfe, John Carew, Ph.D., Litt.D.
Professor Emeritus of Latin, University of Pennsylvania.
4014 Pine Street, Philadelphia, Pa. | 1907 |
| Rosenbach, A. S. W., B.S., Ph.D., D.F.A.
Author, Bibliographer, President, Gratz College.
1320 Walnut Street, Philadelphia, Pa. | 1928 |

	Date of Election
Rostovtzeff, Michael I., Ph.D., LL.D. Professor of Ancient History and Archaeology, Yale University. 470 Whitney Avenue, New Haven, Conn.	1929
Rowe, Leo S., A.B., Ph.B., Ph.D. Director General, Pan-American Union, Washington, D. C.	1911
Russell, Henry Norris, A.M., Ph.D., D.Sc. Professor of Astronomy, Director, Princeton University Observatory. 79 Alexander Street, Princeton, N. J.	1913
Ruthven, Alexander G., B.S., Ph.D., LL.D., Sc.D. Zoologist, President, University of Michigan, Ann Arbor, Mich.	1931
Sanders, Henry A., A.B., A.M., Ph.D. Professor of Latin, Chairman, Department of Speech and General Linguistics, University of Michigan. 2037 Geddes Avenue, Ann Arbor, Mich.	1932
†Sapir, Edward, A.M., Ph.D., Sc.D. Professor of Anthropology and Linguistics, Yale University. 224 Edgehill Road, Hamden, New Haven, Conn.	1937
Sarton, George A. L., D.Sc., L.H.D., LL.D. Historian of Science, Editor of <i>Isis</i> . Harvard Library 185, Cambridge, Mass.	1934
‡Sauveur, Albert, Sc.D., Eng.D. Engineer, Professor Emeritus of Metallurgy, Harvard University, Cambridge, Mass.	1919
Scattergood, J. Henry, A.B. Man of Affairs, Treasurer, Haverford College, Bryn Mawr College. Villa Nova, Pa.	1931
Schaeffer, J. Parsons, A.M., M.D., Ph.D., Sc.D. Professor of General Anatomy, Director, Daniel Baugh Institute of Anatomy, Jefferson Medical College. 4634 Spruce Street, Philadelphia, Pa.	1927
Schelling, Felix E., Ph.D., Litt.D., LL.D. Professor Emeritus of English Literature, University of Pennsylvania. Lumberville, Pa.	1902

† Deceased February 4, 1939.

‡ Deceased January 26, 1939.

LIST OF MEMBERS

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Date of
Election

- | | |
|--|------|
| Schlesinger, Frank, B.S., M.S., M.A., Ph.D., Sc.D.
Director, Yale University Observatory.
New Haven, Conn. | 1912 |
| Schramm, Jacob Richard, A.B., Ph.D.
Professor of Botany, Director, Department of Botany,
University of Pennsylvania, Philadelphia, Pa. | 1932 |
| Schuchert, Charles, M.A., LL.D., Sc.D.
Professor Emeritus of Paleontology, Yale University.
Yale Station, New Haven, Conn. | 1913 |
| Schultz, Adolph H.
Associate Professor of Physical Anthropology, School of
Medicine, Johns Hopkins University, Baltimore, Md. | 1936 |
| Schurman, Jacob Gould, A.B., A.M., Sc.D., Ph.D., LL.D.
Administrator, Diplomatist, Formerly President, Cornell
University; United States Ambassador to Germany
(1925-30). 1900 Q Street, Washington, D. C. | 1908 |
| Scott, James Brown, A.B., A.M., J.U.D.
Secretary, Carnegie Endowment for International Peace.
1201 Nineteenth Street, N.W., Washington, D. C. | 1930 |
| Scott, John Morin, A.B.
Lawyer. 1903 Spruce Street, Philadelphia, Pa. | 1926 |
| Scott, William Berryman, M.A., Ph.D., Sc.D., LL.D.
Professor Emeritus of Geology and Paleontology,
Princeton University. 7 Cleveland Lane, Princeton, N. J. | 1886 |
| Seares, Frederick Hanley, B.S., LL.D.
Astronomer, Assistant Director, Mount Wilson
Observatory, Pasadena, Calif. | 1917 |
| See, Thomas Jefferson Jackson, A.M., Lt.M., Sc.M., Ph.D.,
D.Sc.
Astronomer, Geometer, Professor of Mathematics,
United States Navy (ret.). 614 Ohio Street, Vallejo, Calif. | 1897 |
| Setchell, William Albert, A.M., Ph.D.
Professor of Botany, University of California,
Berkeley, Calif. | 1919 |
| Shapley, Harlow, A.M., Ph.D., LL.D., Sc.D.
Astronomer, Director, Harvard College Observatory,
Cambridge, Mass. | 1922 |

	Date of Election
Shotwell, James Thomson, Ph.D., LL.D. Professor of History, Columbia University; Trustee and Director, Division of Economics and History, Carnegie Endowment for International Peace. 405 West 117th Street, New York, N. Y.	1936
Shull, George Harrison, B.S., Ph.D. Professor of Botany and Genetics, Princeton University. 60 Jefferson Road, Princeton, N. J.	1918
Simpson, George Gaylord, Ph.D. Associate Curator of Vertebrate Paleontology, American Museum of Natural History, New York, N. Y.	1936
Singer, Edgar Arthur, Jr., B.S., Ph.D. Professor of Philosophy, University of Pennsylvania. 4224 Chester Avenue, Philadelphia, Pa.	1925
Sioussat, St. George Leakin, Ph.D. Chief, Division of Manuscripts, Incumbent, Chair of American History, Library of Congress, Washington, D. C.	1928
Slipher, Vesto Melvin, A.M., Ph.D., LL.D., Sc.D. Astronomer, Director, Lowell Observatory, Flagstaff, Ariz.	1921
Smith, Preserved, A.M., Ph.D., Litt.D. Professor of History, Cornell University. 156 Cascadilla Park, Ithaca, N. Y.	1937
Smyth, Charles Phelps, A.B., A.M., Ph.D. Professor of Chemistry, Princeton University. 22 Morven Street, Princeton, N. J.	1932
Spoehr, Herman Augustus, Ph.D., Sc.D. Chairman, Division of Plant Biology, Carnegie Institution of Washington, Stanford University, Calif.	1931
Sprague, Oliver Mitchell Wentworth, A.M., Ph.D., Litt.D. Edmund Cogswell Converse Professor of Banking and Finance, Harvard Graduate School of Business, Soldier's Field, Boston, Mass.	1938
Stebbins, Joel, Ph.D., Sc.D. Professor of Astronomy, Director, Washburn Observatory, University of Wisconsin, Madison, Wis.	1925

LIST OF MEMBERS

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Date of
Election

- | | |
|--|------|
| Stefansson, Vilhjalmur, Ph.D., LL.D.
Arctic Explorer, Geographer and Adviser on Northern
Operations to Pan-American Airways.
Harvard Club, New York, N. Y. | 1923 |
| Stengel, Alfred, M.D., Sc.D., LL.D.
Physician, Professor of Medicine, Vice-president,
University of Pennsylvania. Maloney Building,
36th and Spruce Streets, Philadelphia, Pa. | 1903 |
| Stillwell, Lewis Buckley, Sc.D.
Electrical Engineer. Elm Road, Princeton, N. J. | 1898 |
| Stockard, Charles R., M.S., Ph.D., M.D., Sc.D.
Professor of Anatomy, Cornell Medical College.
1300 York Avenue, New York, N. Y. | 1924 |
| Stone, Witmer, A.M., Sc.D.
Zoologist, Vice-president, Curator, Department of Verte-
brates, Academy of Natural Sciences of Philadelphia,
Nineteenth and the Parkway, Philadelphia, Pa. | 1913 |
| Struve, Otto, Ph.D.
Professor of Astrophysics, University of Chicago;
Director, Yerkes Observatory, Williams Bay, Wis. | 1937 |
| Sturtevant, Alfred Henry, Ph.D.
Professor of Genetics, California Institute of Technology,
Pasadena, Calif. | 1936 |
| Sumner, Francis Bertody, Ph.D.
Professor of Biology, Scripps Institution of Oceanogra-
phy, University of California, La Jolla, Calif. | 1938 |
| Swann, William Francis Gay, M.A., D.Sc.
Physicist, Director, Bartol Research Foundation,
Whittier Place, Swarthmore, Pa. | 1926 |
| Tatlock, John S. P., A.M., Ph.D.
Professor of English, University of California.
1994 San Antonio Street, Berkeley, Calif. | 1937 |
| Taussig, Frank W., A.B., Ph.D., LL.B., Litt.D., LL.D.
Professor Emeritus of Political Economy,
Harvard University, Cambridge, Mass. | 1929 |

	Date of Election
Taylor, Deems, A.B., Mus.D., Litt.D. Musician, Composer, Writer. The Haviland Road, Stamford, Conn.	1934
Taylor, Henry Osborn, A.B., LL.B., D.Litt., L.H.D. Author, Historian. 135 East 66th Street, New York, N. Y.	1926
Taylor, Hugh Stott, D.Sc. Professor of Physical Chemistry, Chairman, Department of Chemistry, Princeton University. 115 Broadmead, Princeton, N. J.	1928
Tennent, David Hilt, Ph.D. Professor of Biology, Bryn Mawr College. 818 Summit Grove Avenue, Bryn Mawr, Pa.	1938
Thorndike, Edward L., A.B., A.M., Ph.D., Sc.D., LL.D. Professor of Educational Psychology, Teachers College, Columbia University, New York, N. Y.	1930
Tolman, Richard Chace, Ph.D. Professor of Physical Chemistry and Mathematical Physics, California Institute of Technology, Pasadena, Calif.	1932
Tozzer, Alfred Marston, A.B., A.M., Ph.D. Professor of Anthropology, Harvard University. 7 Bryant Street, Cambridge, Mass.	1937
Trelease, William, Sc.D., LL.D. Professor Emeritus of Botany, University of Illinois, Urbana, Ill.	1903
True, Rodney H., M.S., Ph.D. Professor Emeritus of Botany, Director, Morris Arboretum, University of Pennsylvania, Philadelphia, Pa.	1923
Tucker, Richard Hawley, C.E., Sc.D. Astronomer, Formerly of Lick Observatory. 1525 Waverly Street, Palo Alto, Calif.	1908
Tyzzar, Ernest Edward, Ph.B., A.M., M.D., Sc.D. Professor of Comparative Pathology, Harvard Medical School. Wakefield, Mass.	1931
Urey, Harold Clayton, Ph.D. Professor of Chemistry, Columbia University. 355 Highwood Avenue, Leonia, N. J.	1935

LIST OF MEMBERS

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Date of
Election

- | | |
|---|------|
| Van Slyke, Donald Dexter, Ph.D., Sc.D.
Biochemist, Rockefeller Institute for Medical Research,
66th Street and York Avenue, New York, N. Y. | 1938 |
| Vaclair, Samuel M., Sc.D.
Engineer, Chairman of the Board, Baldwin Locomotive
Works. 123 South Broad Street, Philadelphia, Pa. | 1899 |
| Vaughan, Thomas Wayland, A.M., Ph.D., LL.D.
Geologist and Oceanographer, Director Emeritus,
Scripps Institution of Oceanography. 3333 P Street,
Washington, D. C. | 1923 |
| Veblen, Oswald, A.B., Ph.D., D.Sc.
Professor of Mathematics, Institute for Advanced Study.
58 Battle Road, Princeton, N. J. | 1912 |
| von Neumann, John, Ph.D., C.E.
Professor of Mathematics, Institute for Advanced Study.
Fine Hall, Princeton, N. J. | 1938 |
| Warren, Charles Hyde, Ph.B., Ph.D.
Dean, Sheffield Scientific School, Professor of Geology,
Yale University. 59 Lincoln Street, New Haven, Conn. | 1928 |
| Webster, David Locke, A.B., Ph.D.
Professor and Executive Head, Department of Physics,
Stanford University, Calif. | 1922 |
| Wetherill, Samuel Price, B.S., LL.D.
Engineer. 1202 Morris Building, Philadelphia, Pa. | 1933 |
| Wetmore, Alexander, A.B., M.S., Ph.D., D.Sc.
Zoologist, Assistant Secretary, Smithsonian Institution;
In Charge, United States National Museum,
Washington, D. C. | 1930 |
| Weyl, Hermann
Professor of Mathematics, Institute for Advanced Study.
Fine Hall, Princeton, N. J. | 1935 |
| Whipple, George Hoyt, M.D., M.A., D.Sc., LL.D.
Professor of Pathology, Dean, School of Medicine and
Dentistry, University of Rochester. 320 Westminister
Road, Rochester, N. Y. | 1938 |
| Whitney, Willis R., S.B., Ph.D., Sc.D., Ch.D., LL.D.
Chemist, Vice-president in Charge of Research,
General Electric Company, Schenectady, N. Y. | 1931 |

	Date of Election
Willis, Bailey, E.M., C.E., Ph.D. Professor Emeritus of Geology, Stanford University, Calif.	1905
Willits, Joseph Henry, A.M., Ph.D., LL.D. Director of the Social Sciences, Rockefeller Foundation, 49 West 49th Street, New York, N. Y.	1938
Wilson, Edwin Bidwell, A.B., Ph.D. Professor of Vital Statistics, Harvard School of Public Health. 55 Shattuck Street, Boston, Mass.	1917
Wilson, George Grafton, Ph.D., LL.D. Professor Emeritus of International Law, Harvard University, Cambridge, Mass.	1936
Wilson, Harold Albert, M.A., M.Sc., D.Sc. Professor of Physics, The Rice Institute, Houston, Texas	1914
† Wilson, Henry Van Peters, A.B., Ph.D. Kenan Professor of Zoology, University of North Carolina, Chapel Hill, N. C.	1932
Wissler, Clark, A.M., Ph.D., LL.D. Professor of Anthropology, Yale University; Curator of Anthropology, American Museum of Natural History, New York, N. Y.	1924
Witmer, Lightner, A.M., Ph.D. Professor Emeritus of Psychology, University of Pennsylvania. Box 186, Devon, Pa.	1897
Woodworth, Robert Sessions, A.B., A.M., Ph.D., Sc.D., LL.D. Professor of Psychology, Columbia University, New York, N. Y.	1936
Wright, Frederick E., Ph.D. Petrologist, Geophysical Laboratory, Carnegie Institution of Washington. 2134 Wyoming Avenue, Washington, D. C.	1914
Wright, Sewall, B.S., M.S., Sc.D. Professor of Zoology, University of Chicago. 5762 Harper Avenue, Chicago, Ill.	1932
Wright, William Hammond, D.Sc. Astronomer, Director, Lick Observatory, Mount Hamilton, Calif.	1935

† Deceased January 4, 1939.

LIST OF MEMBERS

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Date of
Election

Yeatman, Pope, E.M., D.E. Mining Engineer. 165 Broadway, New York, N. Y.	1920
Yerkes, Robert Mearns, Ph.D., D.Sc., LL.D. Director, Yale Laboratories of Primate Biology; Professor of Psychobiology, Yale University, New Haven, Conn.	1936
Young, James Thomas, Ph.D. Political Scientist, Professor of Public Administration, University of Pennsylvania, Philadelphia, Pa.	1933
Young, Owen D., A.B., D.H.L., LL.B., Litt.D., D.C.S. Lawyer, Chairman, General Electric Company. 570 Lexington Avenue, New York, N. Y.	1929
Zeleny, John, M.A., Ph.D. Professor of Physics, Yale University. 44 Cold Spring Street, New Haven, Conn.	1915
Zinsser, Hans, M.D., Sc.D. Professor of Bacteriology and Immunology, Harvard Medical School. 52 Chestnut Street, Boston, Mass.	1937
Total Resident Members—408	
December 31, 1938.	

FOREIGN MEMBERS

	Date of Election
Adams, Frank Dawson, Ph.D., D.Sc., LL.D., F.R.S. Geologist, Vice-principal Emeritus, McGill University, Montreal, Canada.	1916
Adrian, Edgar Douglas, M.A., M.D., Sc.D., LL.D., F.R.S. Professor of Physiology, Cambridge University. St. Chad's, Grange Road, Cambridge, England.	1938
Brögger, Waldemar Christofer, LL.D., D.Sc., F.R.S., Ph.D. Formerly Professor of Mineralogy and Geology, Oslo University, Oslo, Norway.	1899
Debye, Peter Director, Kaiser Wilhelm-Institut für Physik, Berlin-Dahlem, Boltzmannstrasse, Germany.	1936
Dirac, Paul Adrien Maurice, Ph.D., F.R.S. Lucasian Professor of Mathematics, Cambridge University. St. John's College, Cambridge, England.	1938
Eddington, Sir Arthur Stanley, M.A., B.Sc., D.Sc., LL.D., F.R.S. Astronomer, Director, The Observatory, Cambridge, England.	1931
Evans, Sir Arthur, Kt., M.A., D.Litt., LL.D., F.R.S., F.B.A. Extraordinary Professor of Prehistoric Archaeology, Oxford University. Youlbury, Oxford, England.	1913
Heisenberg, Werner, Ph.D. Professor of Theoretical Physics, University of Leipzig. Bozenerweg 14, Leipzig, Germany.	1937
Hilbert, David Professor of Mathematics, University of Göttingen. Wilhelm-Weber-Strasse, Göttingen, Germany.	1932

LIST OF MEMBERS

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Date of
Election

- | | |
|---|------|
| Hill, Archibald Vivian, M.A., Sc.D., LL.D., M.D.
Physiologist, Foulerton Research Professor and Secretary
of the Royal Society. University of London, University
College, Gower Street, London, W.C.1, England. | 1938 |
| Hopkins, Sir Frederick Gowland, M.A., M.B., D.Sc.,
LL.D., D.C.L., F.R.S.
Physiologist, Professor of Biochemistry, University of
Cambridge. Saxmeadham, Grange Road,
Cambridge, England. | 1937 |
| Hu Shih, A.B., Ph.D., LL.D., Litt.D., L.H.D.
Philosopher, Dean, Peiping National University;
Chinese Ambassador to United States.
Chinese Embassy, Washington, D. C. | 1936 |
| Irvine, Sir James Colquhoun, C.B.E., Ph.D., Sc.D., LL.D.,
D.C.L., F.R.S.
Chemist, Principal and Vice-chancellor, University of
St. Andrews, Fifeshire, Scotland. | 1933 |
| Keith, Sir Arthur, Kt., F.R.S., M.D., D.Sc., F.R.C.S., LL.D.
Anthropologist, Master, Buckston Browne Research
Farm, Downe, Farnborough, Kent, England. | 1931 |
| Keith, Arthur Berriedale, D.C.L., D.Litt., LL.D.
Barrister at Law, Advocate and Orientalist, Regius
Professor of Sanskrit and Comparative Philology, Lecturer
on the Constitution of the British Empire, University of
Edinburgh, Edinburgh, Scotland. | 1935 |
| Kenyon, Sir Frederic George, M.A., D.Litt., LL.D.,
L.H.D., Ph.D.
Archaeologist, Secretary, British Academy; President,
London Society of Antiquaries; Formerly Director,
British Museum. Kirkstead, Godstone, Surrey, England. | 1937 |
| Larmor, Sir Joseph, Kt., M.A., Sc.D., LL.D., D.C.L.,
F.R.S.
Physicist, Professor Emeritus of Mathematics,
Cambridge University; Fellow, St. John's College,
Cambridge, England. | 1913 |
| Lodge, Sir Oliver Joseph, Kt., Sc.D., LL.D., F.R.S.
Physicist, Formerly Principal, University of Birmingham,
Normanton, Lake, Salisbury, England. | 1901 |

	Date of Election
†McMurrich, James Playfair, M.A., Ph.D., LL.D. Professor Emeritus of Anatomy, Anatomical Laboratory, University of Toronto, Toronto, Canada.	1907
de Margerie, Emmanuel Geologist, Formerly President, Geological Society of France. 110 Rue du Bac, Paris VII, France.	1932
Penck, Albrecht F. K., Ph.D., Sc.D. Professor Emeritus of Geography, University of Berlin. Knesebeckstrasse 48, Berlin W15, Germany.	1908
Petrie (William Matthew), Sir Flinders, Kt., D.C.L., Litt.D., LL.D., Ph.D., F.R.S., F.S.A. Professor Emeritus of Egyptology, University College, London; Founder, British School of Egyptian Archaeology. Care American Schools of Oriental Research, Jerusalem, Palestine.	1905
Picard, Emile, Sc.D. Mathematician, Permanent Secretary, Academy of Sciences, Professor, Paris University. 25 Quai Conti, Paris (vi), France.	1910
Planck, Max, Ph.D., M.D., D.Sc. Professor of Physics, University of Berlin, Berlin, Germany.	1933
Plaskett, John Stanley, C.B.E., B.A., D.Sc., LL.D., F.R.S. Director (ret.), Dominion Astrophysical Observatory. 318 Armit Street, Esquimalt, Victoria, B. C., Canada.	1930
Prain, Sir David, Kt., M.A., M.B., LL.D., F.R.S. Botanist, Formerly Trustee, British Museum and Director, Royal Botanic Gardens, Kew. The Well Farm, Warlingham, Surrey, England.	1917
Richardson, Owen Willans, M.A., D.Sc., LL.D., F.R.S. Physicist, Research Professor of the Royal Society; Director of Research in Physics, King's College. Chandos Lodge, Alton, Hants, England.	1910
Rist, Charles, LL.D. Professor of Political Economy, University of Paris. 18 bis, Rue du Parc de Clagny, Versailles, France.	1938

† Deceased, February 9, 1939.

LIST OF MEMBERS

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Date of
Election

Spemann, Hans, Ph.D., Sc.D.	1937
Professor of Zoology, Freiburg University. Freiburg, I.B., Mercystrasse 35, Germany.	
Szombathy, Josef Hofrat	1886
Anthropologist. Vienna XIX, Obkirchergasse 15, Austria.	
Temperley, Harold William Vazeille, M.A., Litt.D.	1938
Professor of Modern History, Cambridge University; Master of Peterhouse, Cambridge, England.	
Thomson, Sir Joseph John, O.M., Kt., M.A., Sc.D., Ph.D., LL.D., F.R.S.	1903
Physicist, Master, Trinity College. Trinity Lodge, Cambridge, England.	
Volterra, Vito, Ph.D., Sc.D., LL.D., Math.Dr., Phys.Dr.	1914
Professor of Mathematics, Universities of Pisa, Turin and Rome. Via in Lucina 17, Rome, Italy.	
Wilkins, Sir Hubert, Kt., M.C., F.R.G.S., M.B.O.U.	1930
Geographer. Royal Society's Club, St. James, London, England.	

Total Foreign Members—34

December 31, 1938.

CLASSIFIED LIST OF MEMBERS

CLASS I. MATHEMATICAL AND PHYSICAL SCIENCES

Mathematics

Alexander, James W.....	Princeton, N. J.
Bateman, Harry.....	Pasadena, Calif.
Bell, Eric Temple.....	Pasadena, Calif.
Birkhoff, George David.....	Cambridge, Mass.
Bliss, Gilbert Ames	Chicago, Ill.
Dirac, Paul Adrien Maurice.....	Cambridge, England
Dresden, Arnold.....	Swarthmore, Pa.
Eisenhart, Luther Pfahler.....	Princeton, N. J.
Henderson, Robert.....	Crown Point, N. Y.
Hilbert, David.....	Göttingen, Germany
Huntington, Edward Vermilye.....	Cambridge, Mass.
Lefschetz, Solomon.....	Princeton, N. J.
Lovett, Edgar Odell	Houston, Texas
Mitchell, Howard Hawks.....	Merion, Pa.
Morse, Marston.....	Princeton, N. J.
Osgood, William Fogg.....	Belmont, Mass.
Picard, Emile.....	Paris, France
Veblen, Oswald.....	Princeton, N. J.
Volterra, Vito	Rome, Italy
von Neumann, John.....	Princeton, N. J.
Weyl, Hermann.....	Princeton, N. J.

Astronomy

Abbot, Charles Greeley.....	Washington, D. C.
Adams, Walter Sydney.....	Pasadena, Calif.
Aitkin, Robert Grant.....	Berkeley, Calif.
Cannon, Annie J.....	Cambridge, Mass.
Cook, Gustavus Wynne.....	Wynnewood, Pa.
Curtis, Heber Doust.....	Ann Arbor, Mich.
Dugan, Raymond Smith.....	Princeton, N. J.
Eddington, Arthur Stanley.....	Cambridge, England
Gaposchkin, Cecilia Payne.....	Cambridge, Mass.

Hubble, Edwin P.....	Pasadena, Calif.
Lampland, Carl O.....	Flagstaff, Ariz.
Leuschner, Armin Otto.....	Berkeley, Calif.
Miller, John Anthony.....	Wallingford, Pa.
Mitchell, Samuel Alfred.....	University, Va.
Moulton, Forest Ray.....	Washington, D. C.
Olivier, Charles P.....	Upper Darby, Pa.
Plaskett, John Stanley.....	Victoria, B. C., Canada
Russell, Henry Norris.....	Princeton, N. J.
Schlesinger, Frank.....	New Haven, Conn.
Seares, Frederick Hanley.....	Pasadena, Calif.
See, Thomas Jefferson Jackson.....	Vallejo, Calif.
Shapley, Harlow.....	Cambridge, Mass.
Slipher, Vesto Melvin.....	Flagstaff, Ariz.
Stebbins, Joel.....	Madison, Wis.
Struve, Otto.....	Williams Bay, Wis.
Tucker, Richard Hawley.....	Palo Alto, Calif.
Wright, William Hammond.....	Mt. Hamilton, Calif.

Physics

Adams, Edwin Plimpton.....	Princeton, N. J.
Anderson, Carl David.....	Pasadena, Calif.
Bridgman, Percy Williams.....	Cambridge, Mass.
Briggs, Lyman J.....	Washington, D. C.
Compton, Arthur Holly.....	Chicago, Ill.
Compton, Karl Taylor.....	Cambridge, Mass.
Coolidge, William David.....	Schenectady, N. Y.
Crew, Henry.....	Evanston, Ill.
Darrow, Karl Kelchner.....	New York, N. Y.
Davisson, Clinton J.....	New York, N. Y.
Debye, Peter.....	Berlin, Germany
Dempster, Arthur Jeffrey.....	Chicago, Ill.
Einstein, Albert.....	Princeton, N. J.
Foote, Paul Darwin.....	Pittsburgh, Pa.
Franck, James.....	Chicago, Ill.
Goodspeed, Arthur Willis.....	Philadelphia, Pa.
Heisenberg, Werner.....	Leipzig, Germany
Humphreys, William Jackson.....	Washington, D. C.
Ives, Herbert E.....	Montclair, N. J.
Larmor, Joseph.....	Cambridge, England
Lawrence, Ernest Orlando.....	Berkeley, Calif.
Lodge, Oliver Joseph.....	Salisbury, England
Loomis, Alfred Lee.....	Tuxedo Park, N. Y.

Lyman, Theodore.....	Cambridge, Mass.
Magie, William Francis.....	Princeton, N. J.
Mees, Charles Edward Kenneth.....	Rochester, N. Y.
Miller, Dayton Clarence.....	Cleveland, Ohio
Millikan, Robert Andrews.....	Pasadena, Calif.
Planck, Max.....	Berlin, Germany
Richards, Horace Clark.....	Philadelphia, Pa.
Richardson, Owen Willans.....	Alton, Hants, England
Richtmyer, Floyd K.....	Ithaca, N. Y.
Swann, William Francis Gay	Swarthmore, Pa.
Thomson, Joseph John.....	Cambridge, England
Tolman, Richard Chace.....	Pasadena, Calif.
Webster, David Locke.....	Stanford University, Calif.
Wilson, Harold Albert.....	Houston, Texas
Zeleny, John.....	New Haven, Conn.

Chemistry

Adams, Roger.....	Urbana, Ill.
Andrews, Donald Hatch.....	Baltimore, Md.
Baekeland, Leo H.....	New York, N. Y.
Bancroft, Wilder Dwight.....	Ithaca, N. Y.
deBenneville, James S.....	Philadelphia, Pa.
Bogert, Marston Taylor.....	New York, N. Y.
Conant, James Bryant.....	Cambridge, Mass.
Cottrell, Frederick Gardner.....	Washington, D. C.
Du Pont, Francis I.....	Wilmington, Del.
Du Pont, Pierre Samuel.....	Wilmington, Del.
Gomberg, Moses.....	Ann Arbor, Mich.
Harkins, William Draper.....	Chicago, Ill.
Hawk, Philip Bovier.....	New York, N. Y.
Hopkins, B Smith.....	Urbana, Ill.
Hulett, George A.....	Princeton, N. J.
Irvine, James Colquhoun.....	Fifeshire, Scotland
Keyes, Frederick George.....	Cambridge, Mass.
Lamb, Arthur Becket.....	Cambridge, Mass.
Langmuir, Irving.....	Schenectady, N. Y.
Levene, Phoebus A.....	New York, N. Y.
Lewis, Gilbert Newton.....	Berkeley, Calif.
Northrop, John Howard.....	Princeton, N. J.
Noyes, William Albert.....	Urbana, Ill.
Patterson, Lamar Gray.....	Perdido Beach, Ala.
Pauling, Linus Carl.....	Pasadena, Calif.

Reese, Charles Lee.....	Wilmington, Del.
Smyth, Charles Phelps.....	Princeton, N. J.
Taylor, Hugh Stott.....	Princeton, N. J.
Urey, Harold Clayton.....	Leonia, N. J.
Whitney, Willis R.....	Schenectady, N. Y.

Engineering

Bush, Vannevar.....	Washington, D. C.
Davis, Harvey N.....	Hoboken, N. J.
Derleth, Charles, Jr.....	Berkeley, Calif.
Dunn, Gano.....	New York, N. Y.
Durand, William Frederick.....	Stanford University, Calif.
Emmet, William LeRoy.....	Schenectady, N. Y.
Hoover, Herbert.....	Stanford University, Calif.
Jackson, Dugald Caleb.....	Cambridge, Mass.
Jewett, Frank Baldwin.....	New York, N. Y.
Kennelly, Arthur Edwin.....	Cambridge, Mass.
Kettering, Charles Franklin.....	Dayton, Ohio
Pender, Harold.....	Philadelphia, Pa.
†Sauveur, Albert.....	Cambridge, Mass.
Stillwell, Lewis Buckley.....	Princeton, N. J.
Vaoclain, Samuel M.....	Philadelphia, Pa.
Wetherill, Samuel Price.....	Haverford, Pa.
Yeatman, Pope.....	New York, N. Y.

CLASS II. GEOLOGICAL AND BIOLOGICAL SCIENCES

Geology, Paleontology, Geography

Adams, Frank Dawson.....	Montreal, Canada
Berkey, Charles Peter.....	New York, N. Y.
Berry, Edward Wilber.....	Baltimore, Md.
Bowen, Norman L.....	Chicago, Ill.
Bowman, Isaiah.....	Baltimore, Md.
Brögger, Waldemar Christofer.....	Oslo, Norway
Bryant, William L.....	Providence, R. I.
Buddington, Arthur F.....	Princeton, N. J.
Byrd, Richard Evelyn.....	Boston, Mass.
Case, Ermine Cowles.....	Ann Arbor, Mich.
Cross, Whitman.....	Chevy Chase, Md.
Daly, Reginald Aldworth.....	Cambridge, Mass.

† Deceased.

Day, Arthur L.....	Bethesda, Md.
Gregory, Herbert Ernest.....	Honolulu, Hawaii
Gregory, William King.....	New York, N. Y.
Hobbs, William Herbert.....	Ann Arbor, Mich.
Johnson, Douglas.....	New York, N. Y.
Lawson, Andrew Cowper.....	Berkeley, Calif.
Leith, Charles Kenneth.....	Madison, Wis.
Leverett, Frank.....	Ann Arbor, Mich.
Lindgren, Waldemar.....	Cambridge, Mass.
de Margerie, Emmanuel.....	Paris, France
Merriam, John C.....	Washington, D. C.
Penck, Albrecht F. K.....	Berlin, Germany
Reid, Harry Fielding.....	Baltimore, Md.
Schuchert, Charles.....	New Haven, Conn.
Scott, William Berryman.....	Princeton, N. J.
Simpson, George Gaylord.....	New York, N. Y.
Stefansson, Vilhjalmur.....	New York, N. Y.
Vaughan, Thomas Wayland.....	Washington, D. C.
Warren, Charles Hyde.....	New Haven, Conn.
Wilkins, Hubert.....	London, England
Willis, Bailey.....	Stanford University, Calif.
Wright, Frederick E.....	Washington, D. C.

Zoology, Anatomy

Andrews, Roy Chapman	New York, N. Y.
Barbour, Thomas.....	Boston, Mass.
Bigelow, Henry Bryant.....	Cambridge, Mass.
Birge, Edward Asahel.....	Madison, Wis.
Bumpus, Hermon Carey.....	Duxbury, Mass.
Calvert, Philip Powell.....	Cheyney, Pa.
Castle, William Ernest.....	Berkeley, Calif.
Chapman, Frank Michler.....	New York, N. Y.
Cockerell, Theodore D. A.....	Boulder, Colo.
Coghill, George Ellett.....	Gainesville, Fla.
Conklin, Edwin Grant.....	Princeton, N. J.
Dahlgren, Ulric.....	Princeton, N. J.
Davenport, Charles Benedict.....	Cold Spring Harbor, L. I., N. Y.
Harrison, Ross G.....	New Haven, Conn.
Howard, Leland Ossian.....	Washington, D. C.
Jennings, Herbert S.....	Baltimore, Md.
Kofoed, Charles A.....	Berkeley, Calif.
Lillie, Frank Rattray.....	Chicago, Ill.
McClung, Clarence E.....	Philadelphia, Pa.

McClure, Charles F. W.....	Princeton, N. J.
McGregor, James Howard.....	New York, N. Y.
†McMurrich, James Playfair.....	Toronto, Canada
Mark, Edward Laurens.....	Cambridge, Mass.
Miller, Gerrit Smith, Jr.....	Washington, D. C.
Moore, J. Percy.....	Philadelphia, Pa.
Morgan, Thomas Hunt.....	Pasadena, Calif.
Noble, G. Kingsley.....	New York, N. Y.
Parker, George Howard.....	Cambridge, Mass.
Pearl, Raymond.....	Baltimore, Md.
Ruthven, Alexander G.....	Ann Arbor, Mich.
Schaeffer, J. Parsons.....	Philadelphia, Pa.
Spemann, Hans.....	Freiburg, Germany
Stockard, Charles R.....	New York, N. Y.
Stone, Witmer.....	Philadelphia, Pa.
Sturtevant, Alfred Henry.....	Pasadena, Calif.
Sumner, Francis Bertody.....	La Jolla, Calif.
Tennent, David Hilt.....	Bryn Mawr, Pa.
Wetmore, Alexander.....	Washington, D. C.
†Wilson, Henry Van Peters.....	Chapel Hill, N. C.
Wright, Sewall.....	Chicago, Ill.

Botany, Bacteriology

Allen, Charles Elmer.....	Madison, Wis.
Arthur, Joseph Charles.....	Lafayette, Ind.
Bailey, Irving Widmer.....	Cambridge, Mass.
Bailey, Liberty Hyde.....	Ithaca, N. Y.
Bartlett, Harley Harris.....	Ann Arbor, Mich.
Blakeslee, Albert F.....	Cold Spring Harbor, L. I., N. Y.
Campbell, Douglas Houghton.....	Stanford University, Calif.
Cleland, Ralph Erskine.....	Bloomington, Ind.
Crocker, William.....	Yonkers, N. Y.
Davis, Bradley Moore.....	Ann Arbor, Mich.
Duggar, Benjamin Minge.....	Madison, Wis.
Fernald, Merritt Lyndon.....	Cambridge, Mass.
Harper, Robert A.....	New York, N. Y.
Jones, Lewis Ralph.....	Madison, Wis.
Livingston, Burton E.....	Baltimore, Md.
MacDougal, Daniel Trembly.....	Carmel, Calif.
Macfarlane, John Muirhead.....	Philadelphia, Pa.
Merrill, Elmer Drew.....	Jamaica Plain, Mass.
Moore, George Thomas.....	St. Louis, Mo.

†Deceased.

Novy, Frederick G.....	Ann Arbor, Mich.
Prain, David.....	Warlingham, Surrey, England
Schramm, Jacob Richard.....	Philadelphia, Pa.
Setchell, William Albert.....	Berkeley, Calif.
Shull, George Harrison.....	Princeton, N. J.
Spoehr, Herman Augustus.....	Stanford University, Calif.
Trelease, William.....	Urbana, Ill.
True, Rodney H.....	Philadelphia, Pa.
Zinsser, Hans.....	Boston, Mass.

Anthropology, Psychology

Angell, James Rowland.....	New Haven, Conn.
Boas, Franz.....	Grantwood, N. J.
Cattell, James McKeen.....	Garrison, N. Y.
Hooton, Earnest A.....	Cambridge, Mass.
Hrdlička, Aleš.....	Washington, D. C.
Keith, Arthur.....	Farnborough, Kent, England
Lashley, Karl Spencer.....	Cambridge, Mass.
MacCurdy, George Grant.....	Old Lyme, Conn.
Paton, Stewart.....	Franconia, N. H.
Schultz, Adolph H.....	Baltimore, Md.
Szombathy, Josef Hofrat.....	Vienna, Austria
Thorndike, Edward L.....	New York, N. Y.
Tozzer, Alfred Marston.....	Cambridge, Mass.
Wissler, Clark.....	New York, N. Y.
Witmer, Lightner.....	Philadelphia, Pa.
Woodworth, Robert Sessions.....	New York, N. Y.
Yerkes, Robert Mearns.....	New Haven, Conn.

Physiology, Pathology

Adrian, Edgar Douglas.....	Cambridge, England
Benedict, Francis Gano.....	Machiasport, Maine
Bronk, Detlev W.....	Philadelphia, Pa.
Brubaker, Albert P.....	Philadelphia, Pa.
Cannon, Walter Bradford.....	Boston, Mass.
Carlson, Anton Julius.....	Chicago, Ill.
Chittenden, Russell H.....	New Haven, Conn.
Erlanger, Joseph.....	St. Louis, Mo.
Flexner, Simon.....	New York, N. Y.
Forbes, Alexander.....	Boston, Mass.
Fox, Herbert.....	Philadelphia, Pa.
Gasser, Herbert Spencer.....	New York, N. Y.

Gies, William J.....	New York, N. Y.
Harvey, E. Newton.....	Princeton, N. J.
Henderson, Lawrence J.....	Cambridge, Mass.
Henderson, Yandell.....	New Haven, Conn.
Hill, Archibald Vivian.....	London, England
Hopkins, Frederick Gowland.....	Cambridge, England
Howell, William Henry.....	Baltimore, Md.
Jacobs, Merkel Henry.....	Philadelphia, Pa.
Landsteiner, Karl.....	New York, N. Y.
Lillie, Ralph Stayner.....	Chicago, Ill.
Loeb, Leo.....	St. Louis, Mo.
Murlin, John Raymond.....	Rochester, N. Y.
Osterhout, Winthrop J. V.....	New York, N. Y.
Richards, Alfred Newton.....	Bryn Mawr, Pa.
Riddle, Oscar.....	Cold Spring Harbor, L. I., N. Y.
Tyzzer, Ernest Edward.....	Wakefield, Mass.
Van Slyke, Donald Dexter.....	New York, N. Y.
Whipple, George Hoyt.....	Rochester, N. Y.

Medicine, Pharmacology, Surgery

Carrel, Alexis.....	New York, N. Y.
Crile, George.....	Cleveland, Ohio
Cushing, Harvey.....	New Haven, Conn.
Darrach, William.....	New York, N. Y.
Griffith, J. P. Crozer.....	Philadelphia, Pa.
Heiser, Victor George.....	New York, N. Y.
Joslin, Elliott Proctor.....	Boston, Mass.
Minot, George Richards.....	Boston, Mass.
Norris, George William.....	Dimock, Pa.
Packard, Francis Randolph.....	Philadelphia, Pa.
Pepper, William.....	Philadelphia, Pa.
Ravenel, Mazzyk P.....	Columbia, Mo.
Stengel, Alfred.....	Philadelphia, Pa.

CLASS III. SOCIAL SCIENCES

Economics, Statistics

Commons, John Rogers.....	Madison, Wis.
Day, Edmund Ezra.....	Ithaca, N. Y.
Dodds, Harold Willis.....	Princeton, N. J.
Fetter, Frank Albert.....	Princeton, N. J.
Fisher, Irving.....	New Haven, Conn.
Gay, Edwin Francis.....	San Marino, Calif.

Huebner, Solomon Stephen.....	Merion, Pa.
Johnson, Emory R.....	Philadelphia, Pa.
Kemmerer, Edwin Walter.....	Princeton, N. J.
Merriam, Charles Edward.....	Chicago, Ill.
Mitchell, Wesley Clair.....	New York, N. Y.
Moulton, Harold Glenn.....	Washington, D. C.
Patterson, Ernest Minor.....	Philadelphia, Pa.
Rist, Charles	Versailles, France
Sprague, Oliver M. W.....	Boston, Mass.
Taussig, Frank W.....	Cambridge, Mass.
Willits, Joseph Henry.....	Philadelphia, Pa.
Wilson, Edwin Bidwell.....	Boston, Mass.
Young, James Thomas	Philadelphia, Pa.

Modern History

Adams, James Truslow.....	Southport, Conn.
Andrews, Charles McLean.....	New Haven, Conn.
Beard, Charles Austin.....	New Milford, Conn.
Becker, Carl.....	Ithaca, N. Y.
Bolton, Herbert Eugene.....	Berkeley, Calif.
Cheyney, Edward Potts.....	Media, Pa.
Dodd, William Edward.....	Round Hill, Va.
Farrand, Max.....	San Marino, Calif.
Ford, Worthington Chauncey.....	Seine-et-Oise, France
Fox, Dixon Ryan.....	Schenectady, N. Y.
Greene, Evarts B.....	New York, N. Y.
Hazen, Charles D.....	New York, N. Y.
Lingelbach, William E.....	Philadelphia, Pa.
McIlwain, Charles Howard	Belmont, Mass.
Morison, Samuel Eliot.....	Boston, Mass.
Read, Conyers.....	Philadelphia, Pa.
Shotwell, James Thomson.....	New York, N. Y.
Sioussat, St. George Leakin.....	Washington, D. C.
Temperley, Harold William Vazeille.....	Cambridge, England

Jurisprudence

Corwin, Edward Samuel.....	Princeton, N. J.
Davis, John William.....	New York, N. Y.
Goodrich, Herbert Funk.....	Philadelphia, Pa.
Hughes, Charles Evans.....	Washington, D. C.
Keith, Arthur Berriedale.....	Edinburgh, Scotland

Miller, Hunter.....	Victoria, B. C., Canada
Moore, John Bassett.....	New York, N. Y.
Morris, Roland S.....	Philadelphia, Pa.
Paul, J. Rodman.....	Philadelphia, Pa.
Pepper, George Wharton.....	Philadelphia, Pa.
Reeves, Jesse S.....	Ann Arbor, Mich.
Roberts, Owen J.....	Washington, D. C.
Scott, James Brown.....	Washington, D. C.
Scott, John Morin.....	Philadelphia, Pa.
Wilson, George Grafton.....	Cambridge, Mass.

Administration, Government

Butler, Nicholas Murray.....	New York, N. Y.
Delano, Frederic Adrian.....	Washington, D. C.
Fosdick, Raymond Blaine.....	New York, N. Y.
Gates, Thomas Sovereign.....	Philadelphia, Pa.
† Gest, William Purves.....	Merion, Pa.
Gifford, Walter Sherman.....	New York, N. Y.
Guggenheim, William.....	New York, N. Y.
Harkness, Edward S.....	New York, N. Y.
Lowell, Abbott Lawrence.....	Boston, Mass.
Putnam, Herbert.....	Washington, D. C.
Rockefeller, John D., Jr.....	New York, N. Y.
Rowe, Leo S.....	Washington, D. C.
Schurman, Jacob Gould.....	Washington, D. C.
Young, Owen D.....	New York, N. Y.

Affairs

Hayward, Nathan.....	Philadelphia, Pa.
Hopkinson, Edward, Jr.....	Philadelphia, Pa.
Jenks, John Story.....	Philadelphia, Pa.
Johnson, Eldridge Reeves.....	Camden, N. J.
Lamont, Thomas William.....	New York, N. Y.
Lippincott, J. Bertram.....	Philadelphia, Pa.
Mason, William Smith.....	Evanston, Ill.
Morgan, Marshall S.....	Malvern, Pa.
Morris, Lawrence J.....	Philadelphia, Pa.
Norris, George Washington.....	Philadelphia, Pa.
Rhoads, Charles James.....	Bryn Mawr, Pa.
Scattergood, J. Henry.....	Villa Nova, Pa.

† Deceased.

CLASS IV. HUMANITIES

Philosophy, Education

Dewey, John.....	New York, N. Y.
Farrand, Livingston.....	Brewster, N. Y.
Graves, Frank Pierrepont.....	Albany, N. Y.
Haney, John Louis.....	Philadelphia, Pa.
Hu Shih.....	Washington, D. C.
Keppel, Frederick Paul.....	New York, N. Y.
Lovejoy, Arthur Oncken.....	Baltimore, Md.
Penniman, Josiah Harmar.....	Philadelphia, Pa.
Singer, Edgar Arthur, Jr.....	Philadelphia, Pa.

Ancient, Medieval and Cultural History

Ferguson, William Scott.....	Cambridge, Mass.
Leland, Waldo G.....	Washington, D. C.
Rostovtzeff, Michael I.....	New Haven, Conn.
Sarton, George A. L.....	Cambridge, Mass.
Smith, Preserved.....	Ithaca, N. Y.
Taylor, Henry Osborn.....	New York, N. Y.

Archaeology

Albright, William F.....	Baltimore, Md.
Barton, George Aaron.....	Weston, Mass.
Carpenter, Rhys.....	Downingtown, Pa.
Chase, George Henry.....	Cambridge, Mass.
Dinsmoor, William Bell.....	New York, N. Y.
Evans, Arthur.....	Oxford, England
Holland, Leicester Bodine.....	Philadelphia, Pa.
Jayne, Horace Howard Furness.....	Wallingford, Pa.
Kenyon, Frederic George.....	Godstone, Surrey, England
Kidder, Alfred Vincent.....	Cambridge, Mass.
Meritt, Benjamin Dean.....	Princeton, N. J.
Petrie, Flinders.....	Jerusalem, Palestine
Robinson, David Moore.....	Baltimore, Md.

Philology and Languages

Adler, Cyrus.....	Philadelphia, Pa.
Armstrong, Edward Cooke.....	Princeton, N. J.
Aydelotte, Frank.....	Swarthmore, Pa.
Bonner, Campbell.....	Ann Arbor, Mich.
Buck, Carl Darling.....	Chicago, Ill.

Capps, Edward.....	Princeton, N. J.
Chinard, Gilbert.....	Princeton, N. J.
Crawford, J. P. Wickersham.....	Philadelphia, Pa.
Edgerton, Franklin.....	New Haven, Conn.
†Frank, Tenney.....	Baltimore, Md.
Grandgent, Charles Hall.....	Cambridge, Mass.
Hendrickson, George Lincoln.....	New Haven, Conn.
Lancaster, Henry Carrington.....	Baltimore, Md.
Lanman, Charles R.....	Cambridge, Mass.
McDaniel, Walton Brooks.....	Coconut Grove, Fla.
Matthews, Albert.....	Boston, Mass.
Montgomery, James Alan.....	Philadelphia, Pa.
Nitze, William Albert.....	Chicago, Ill.
Prince, John Dyneley.....	New York, N. Y.
Rand, Edward Kennard.....	Cambridge, Mass.
Rolfe, John Carew.....	Philadelphia, Pa.
Sanders, Henry A.....	Ann Arbor, Mich.
†Sapir, Edward.....	New Haven, Conn.
Tatlock, John S. P.....	Berkeley, Calif.

Literature, Fine Arts

Brooke, C. F. Tucker.....	New Haven, Conn.
Cather, Willa.....	New York, N. Y.
Cret, Paul Philippe.....	Philadelphia, Pa.
Cross, Wilbur L.....	New Haven, Conn.
Finley, John Huston.....	New York, N. Y.
Frost, Robert.....	South Shaftsbury, Vt.
Lowes, John Livingston.....	Cambridge, Mass.
Manly, John Matthews.....	Chicago, Ill.
Morey, Charles Rufus.....	Princeton, N. J.
Morris, Harrison Smith.....	Philadelphia, Pa.
O'Neill, Eugene Gladstone.....	Danville, Calif.
Phelps, William Lyon.....	New Haven, Conn.
Repplier, Agnes.....	Philadelphia, Pa.
Rosenbach, A. S. W.....	Philadelphia, Pa.
Schelling, Felix E.....	Lumberville, Pa.
Taylor, Deems.....	Stamford, Conn.

† Deceased.

MEMBERS ELECTED APRIL 22, 1938

CLASS I. MATHEMATICAL AND PHYSICAL SCIENCES

Resident

Carl D. Anderson.....	Pasadena, Calif.
William David Coolidge.....	Schenectady, N. Y.
Frederick Gardner Cottrell.....	Washington, D. C.
Frank Baldwin Jewett.....	Brantwood, N. J.
Frederick George Keyes.....	Cambridge, Mass.
John von Neumann.....	Princeton, N. J.

Foreign

Paul Adrien Maurice Dirac.....	Cambridge, England
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CLASS II. GEOLOGICAL AND BIOLOGICAL SCIENCES

Resident

Karl Spencer Lashley.....	Cambridge, Mass.
John Howard Northrop.....	Princeton, N. J.
Francis Bertody Sumner.....	La Jolla, Calif.
David Hilt Tennent.....	Bryn Mawr, Pa.
Donald Dexter Van Slyke.....	New York, N. Y.
George Hoyt Whipple.....	Rochester, N. Y.

Foreign

Edgar Douglas Adrian.....	Cambridge, England
Archibald Vivian Hill.....	London, England

CLASS III. SOCIAL SCIENCES

Resident

James Truslow Adams.....	New York, N. Y.
Nicholas Murray Butler.....	New York, N. Y.
Edward Hopkinson, Jr.....	Philadelphia, Pa.
Charles Howard McIlwain.....	Belmont, Mass.
Harold Glenn Moulton.....	Washington, D. C.

Oliver Mitchell Wentworth Sprague.....Boston, Mass.
Joseph Henry Willits.....Philadelphia, Pa

Foreign

Charles Rist.....Versailles, France
Harold William Vazeille Temperley.....Cambridge, England

CLASS IV. HUMANITIES

Resident

Campbell Bonner.....Ann Arbor, Mich.
C. F. Tucker Brooke.....New Haven, Conn.
Frederick Paul Keppel.....Montrose, N. Y.
Henry Carrington Lancaster.....Baltimore, Md.
Benjamin Dean Meritt.....Princeton, N. J.
Charles Rufus Morey.....Princeton, N. J.

MEMBERS DECEASED DURING 1938

	Date of Election
Arthur H. Lea, January 7, aet. 78.....	1912
Russell Duane, January 19, aet. 71.....	1906
Henry Herbert Donaldson, January 23, aet. 80.....	1906
George Ellery Hale, February 21, aet. 67.....	1902
Edward Martin, March 17, aet. 79.....	1933
John Jacob Abel, May 26, aet. 81.....	1915
William Wallace Campbell, June 14, aet. 75.....	1903
Owen Wister, July 21, aet. 78.....	1897
Ernest W. Brown, July 22, aet. 78.....	1898
Frederick Tilney, August 7, aet. 63.....	1930
Otto Hilgard Tittmann, August 21, aet. 88.....	1906
George E. de Schweinitz, August 22, aet. 79.....	1912
Jacob B. Eckfeldt, September 7, aet. 92.....	1880
Arthur Stanley Mackenzie, October 2, aet. 73.....	1889
Edward M. East, November 9, aet. 59.....	1916
Albert Barnes Weimer, November 13, aet. 81.....	1927
Friedrich Krauss, aet. 79.....	1889

TABLE OF TOTALS

	Resident Members	Foreign Members
December 31, 1937.....	399	31
Elected during 1938.....	25	5
Deceased during 1938.....	15	2
Resigned during 1938.....	1	0
December 31, 1938.....	408	34

X

OBITUARY NOTICES

JOHN JACOB ABEL

(1857-1938)

Dr. Abel died in Baltimore on May 26, 1938 in his eighty-second year. He was at the time a patient in the Johns Hopkins Hospital for a slight ailment, but his death came unexpectedly from sudden heart failure. After his retirement in 1932 from the active duties of his position as Professor of Pharmacology in the Johns Hopkins Medical School he continued his investigative work as Director of the Laboratory of Endocrine Research, a position which was created for him largely through the generosity of the Carnegie Corporation. In spite of a somewhat frail physique and his advanced age he was constant in attendance at his laboratory during the academic year, although post mortem examination revealed that he suffered from serious cardio-vascular trouble that might well have incapacitated a less ardent worker.

Abel was born in Ohio, near Cleveland, on May 19, 1857, of German parents. His collegiate training was obtained at the University of Michigan from which he received the degree of Ph.B. in 1883. He was then twenty-six years of age, older, therefore, than the usual college graduate. The discrepancy is accounted for by the fact that during his college period there was an interim of three years during which he served as principal of a high school at La Porte, Indiana. At graduation he was looking forward to a career in medicine and it is interesting that instead of remaining at Ann Arbor, where there was a good medical school and where it would have been relatively easy for him to make his degree, he decided to go to Germany, then the mecca for students of medicine who aspired to the best scientific training. It seems probable that he was influenced in arriving at this decision by the advice of Vaughan and Sewall who were then members of the medical faculty at Ann Arbor, and who subsequently became so well known as leaders in the modernization of American medical education. However this

may be Abel showed unusual wisdom and foresight in preparing himself for a career in medical science. From the beginning he sought a fundamental training on the chemical side, although the trend of opinion at that time was not in this direction. Ambitious young men looking forward to such a career were encouraged rather to acquire the techniques of the morphological and experimental laboratories. The great future of chemistry in its application to medical problems was not clearly envisaged, and indeed in this country at that time there was no medical school which could offer adequate courses in the subject. Abel seems to have had from the beginning an understanding of the importance of the chemical approach and a determination to acquire the best training the world could afford. He spent seven years in Germany at various universities. While he studied under the leading masters of anatomy and physiology and did not neglect the clinical sides the greater portion of his time was given to the chemical aspects of physiology and pharmacology. He received his degree of M.D. from the University of Strassburg in 1888 and thereafter spent some time in practical clinical work in Vienna, under the impression that the outlook for a career in medical science in America was not promising, and that it might be necessary on his return to earn a living from the practice of medicine. Actually this alternative was not forced upon him. He was fortunate enough, while working in Schmiedeberg's laboratory, to receive a call to a professorship in the medical school of the University of Michigan. Vaughan who was Dean had made up his mind to develop a modern department of pharmacology in the school such as did not then exist elsewhere in the country. He wrote to Schmiedeberg for suggestions for a suitable head, having in mind the importation of a German pharmacologist. Schmiedeberg advised against this plan and recommended Abel for the chair. His advice was followed although Abel at that time had only his good training to offer as a guaranty of future performance. He was appointed Professor of Materia Medica and Therapeutics, and no better choice could have been made. While he remained at Ann Arbor only two years he inaugurated a department which in the hands of his eminent successors, Cushing and Edmunds, has become a leading center for pharmacological research. When the medical school of the Johns Hopkins University was founded in 1893 Abel was called to the chair of pharmacology and was given charge also of the instruction in physiological chem-

istry, although his title this time was Professor of Pharmacology. It was probably the first chair under that designation established in this country. It was during the forty years that he occupied this position that he did his great work in pharmacology and physiological chemistry and came to be recognized as the Father of American Pharmacology. He was the chief founder and first president of "The American Society for Pharmacology and Experimental Therapeutics." Together with Herter he was responsible for the establishment of *The Journal of Biological Chemistry* and in 1909 he started *The Journal of Pharmacology and Experimental Therapeutics* which he edited for twenty-three years. Through these agencies and his own publications and the work of his advanced students he exerted a profound influence upon the development of pharmacology in this country. His own investigations were largely in the field of biological chemistry. His long training in chemical technique brought its reward when he undertook a study of the nature of the internal secretions. His series of papers upon the chemistry of epinephrine aroused the interest of both chemists and physiologists and may be looked upon as the beginning of the brilliant contributions which have since been made to the subject of endocrine chemistry. His work on epinephrine, his crystallization of insulin and his method of studying the composition of the circulating blood by vividiffusion constitute his best known contributions. Each subject was the occasion for numerous papers. The importance of his work is indicated by the many honors bestowed upon him by scientific societies and institutions. He received honorary degrees from the universities of Cambridge, Aberdeen, Lwow, Michigan, Pittsburgh, Harvard and Yale, and was awarded the Willard Gibbs, Conné and Kober medals and the medal of the Society of Apothecaries, London. He was made a member of the National Academy of Sciences in 1912 and of the American Philosophical Society in 1915. On the day of his death he received news of his election as a Foreign Member of the Royal Society, London.

Abel had a genial lovable personality which inspired affection on the part of his students and friends. His outstanding characteristic, the one most frequently commented upon by those who knew him well, was his whole hearted devotion to scientific research. It was this ideal that sent him to Germany to get his training, and his contacts there with the masters in research, during the golden period of German medicine, served to intensify his enthusiasm. It

was the moving principle in his life's work and no outside interest was permitted to divert him from his laboratory investigations. While he managed very effectively to avoid commitments that tended to involve him in other activities he was always ready to give his time and energy freely to any movement that looked toward the promotion of scientific research. His zeal in this direction showed no abatement in his old age. It was recognized and appreciated by his fellow workers. Without conscious effort on his part he became one of the acknowledged leaders of medical research in this country.

W. H. HOWELL.

NEWTON DIEHL BAKER

(1871-1938)

It is difficult to speak in measured terms of the career of Newton Diehl Baker. His public activities were so varied, embracing so many phases of our national life, that it seems quite futile to attempt to present an adequate picture of the service rendered to the country. Wherever he labored, whether as City Solicitor of Cleveland, as Mayor of that City, or in the great office which he held during the World War, he maintained the high standards of public service and devotion to public welfare which have become indissolubly associated with his name.

Newton Diehl Baker was born at Martinsburg, West Virginia, December 3, 1871, took his Bachelor of Arts degree at Johns Hopkins University in 1892, and his law degree at Washington and Lee University in 1894. In 1902 he was elected City Solicitor of Cleveland, Ohio, which office he held until 1912, when he was elected Mayor of Cleveland. It was while holding this office that on March 7, 1916, President Wilson appointed him Secretary of War which office he held until March 4, 1921.

Although Mr. Baker entered public life soon after becoming a member of the Bar it was not until his appointment as Secretary of War that he became a national figure. It was my privilege as Assistant Secretary of the Treasury, during the World War, to come into close contact with him. I found myself in a peculiarly favorable position to appreciate the magnitude of the service which he rendered to the nation during that period.

The sending of the Expeditionary Forces to France involved

not only important problems of organization and transportation but also moral and social problems of great importance. To all these Secretary Baker brought broad statesmanlike vision as well as a capacity to grasp and deal with multitudinous details. He kept the conduct of the war free from the menace of political interference. Under his guidance billions of dollars were expended and this vast expenditure was made to conform to the highest standards of administrative efficiency and free from any suspicion of corruption. At the close of the war it was his foresight and broad statesmanship that made it possible to return the vast army to civilian life without too great a strain on our economic and social system.

After his retirement from the Secretaryship of War, Mr. Baker resumed the practice of law at Cleveland. He continued, however, to give much of his time to public affairs. In 1928 he was appointed a member of the Permanent Court of Arbitration at The Hague by President Coolidge, and in 1929 President Hoover made him a member of the Law Enforcement Commission. He also took a deep interest, and was active, in the work of the National Law Institute and the American Bar Association. He was elected a member of the American Philosophical Society in April 1936.

L. S. ROWE.

WILLIAM WALLACE CAMPBELL

(1862-1938)

William Wallace Campbell, President Emeritus of the University of California and Director Emeritus of the Lick Observatory, met his death at his home in San Francisco, California on June 14, 1938.

Born on a farm in Hancock County, Ohio, the son of Robert Wilson and Harriet Welch Campbell, on April 11, 1862, he received his early training at the local schools, taking his full share at the same time in the activities of the farm. His farm experience stood him in good stead in later life not only because it aided in building up his active muscular figure, but also because it developed his innate gift of resourcefulness and fixed upon him the habit of attention to practical details.

After teaching in the public schools a year or two, he made his way to the University of Michigan, majoring in engineering courses. Here he formed another habit that distinguished him through life

—the habit of thorough preparation for whatever he undertook to do. It was his custom, as he told me in some of our talks on educational methods and policies, not only to follow the text used in class, say in calculus, but to read one or two other texts covering the same ground, on the side.

At some time during his college course his attention was directed to astronomy, it is said by the reading of Newcomb's *Popular Astronomy*. Taking the courses offered by Professor J. M. Schaeberle, he soon became a skillful observer, and having mastered Watson's text on Theoretical Astronomy during a vacation period, also undertook the computation of comet orbits. He served as assistant in the observatory during the latter part of his term of residence at the university and on receiving the degree of B.S. in engineering in 1886 decided to adopt astronomy as a career. No position in this field being open to him at that time, however, he accepted a professorship of mathematics at the University of Colorado.

Here he met Elizabeth Ballard Thompson, a student at the university, who became his wife on December 28, 1892, and who, with their three sons, Wallace, Douglas and Kenneth, survives him.

When Schaeberle joined the original staff of the Lick Observatory in 1888, Campbell took over his work at Michigan (with the rank of instructor) and carried it on so efficiently as to establish his reputation as a teacher and as a computer of orbits. Finding the larger treatises on practical astronomy, like Chauvenet's, too comprehensive for effective use in teaching undergraduates whose time for the subject was limited, he developed his own lecture course which was published in 1891 under the title *A Handbook¹ of Practical Astronomy* and which is still widely used as a standard text on the subject.

During these years he became deeply interested in astrophysics, then known as the "New Astronomy," and in 1890 spent the summer at the Lick Observatory, working chiefly with Professor James E. Keeler. The impression he made upon Director Holden was so favorable that when Keeler resigned, in 1891, to become director of the Allegheny Observatory, Campbell was chosen as his successor at the Lick.

Then followed a long period of joyous, fruitful activity. Astrophysical research was still in its pioneer stage, the spectrograph

¹ Changed in the second edition (1899) to *Elements*.

just beginning to replace the visual spectroscope. Campbell was deeply interested in every form of spectrographic work and subjects inviting investigation lay ready on every hand. He studied the spectra of comets, of gaseous and planetary nebulae, of the Wolf-Rayet and other peculiar stars, the spectrum of Nova Aurigae and the spectrum of Mars. On every subject he touched he contributed results of significance and importance.

The problem of stellar motions based upon measures of the radial velocities of the stars engaged his particular attention and his pioneer measures made as early as 1896 with the Mills spectrograph, which he had himself designed, set the standard of accuracy for such work. And the program of radial velocity work which he then initiated and which he carried on through the years, first alone, then with the collaboration of Wright, Curtis, Moore and many other able colleagues and assistants working both at the Lick Observatory and at the station on *Cerro San Cristóbal* in Chile, provides the most extensive and homogeneous set of data we have on stellar motions in the line of sight. This great program, with its by-product of the discovery that nearly one-third of the brighter stars are spectroscopic binary systems, Campbell himself regarded as his major contribution to astronomy, but his work on the structure of the lines of planetary nebulae, and on the internal motions in these nebulae, carried out in collaboration with Dr. J. H. Moore, his work on the spectrum of Mars, carried out alone and in collaboration with Dr. S. Albrecht and others, his work on the flash spectrum of the Sun, based on observations with the moving-plate-holder spectrograph (his major contribution to eclipse apparatus), and his work with Dr. R. J. Trumpler, at the 1922 eclipse, on the deflection of light at the Sun's limb, with a battery of cameras specially designed by him, are all of fundamental importance. Dr. D. H. Menzel fully analyzed and discussed the moving plate holder eclipse spectrograms taken by Campbell himself at the eclipse expeditions of 1898, 1900, 1905, 1908, 1918 and 1922, finding all the plates good, and those of 1905 "superb," and Dr. Trumpler's reduction of the 1922 "Einstein plates" fully confirmed the conclusions reached by the English observers at the eclipse of 1919 and constitutes the best evidence we have on the gravitational deflection of light passing close by the Sun's limb.

The untimely death in the summer of 1900 of Dr. James E. Keeler, who had succeeded Dr. Holden as Director of the Lick

Observatory, led to the appointment of Dr. Campbell as his successor. President Wheeler made this appointment on the unanimous recommendation of twelve of the leading astronomers of the world—a most significant tribute to Campbell's ability.

Assuming his new office on January 1, 1901, he promptly proved himself to be an able Director, and his capable administration during the next twenty-three years put the Lick Observatory into the front rank of the observatories of the world. His ambition was now satisfied, he wanted no other position and several times declined flattering offers of positions of great honor and importance elsewhere.

When, on his return from the eclipse expedition to Australia, late in 1922, the Regents of the University of California asked him to accept the presidency of the university, he declined this offer also, and the strongest arguments were required to bring him to reconsider his decision. Even then he hoped soon to be able to return to the observatory and for that reason retained his title of Director and his legal residence at Mount Hamilton.

Of his conduct of his new office, no better statement can be made than that of Regent Chester Rowell: "With a hand always gentle but always firm and never shirking, President Campbell ruled the university wisely and well. Whether in its nominally ruling board, in its faculty, or in its student body, there are problems great and small in all universities. The great ones, Dr. Campbell faced greatly, seeing them in the full perspective of the long future and of their widest ramifications, as was natural to a scientist whose habitual intellectual background had been the whole harmony of the universe. The petty ones he saw in their infinitesimal smallness and sometimes also in their equally measureless contemptibility. He was no passionless supercomptometer but a very human person capable of indignation and disgust. But his contempts were all for the contemptible."

His hope of returning to the directorship at Mount Hamilton was never realized, for he was stricken on the Commencement platform in May 1930 by the disease that led ultimately to his death, and retired from active service in the university on June 30 of the same year.

In 1915, Dr. Campbell was elected President of the American Association for the Advancement of Science and was also called upon to take the leading part in organizing the Pacific Division of

the Association and to become its first President. In 1919, he was one of the leaders in planning the organization of the International Astronomical Union, and served for three years as one of its Vice-presidents. Then, in 1922 he was made President of the Union and in the same year was elected President of the American Astronomical Society. He served as Vice-president of the American Philosophical Society in 1929-30, and as President of the Astronomical Society of the Pacific in 1895 and again in 1910. All of these societies, as well as the many others of which he was an active member profited greatly by his counsel and his organizing ability.

Throughout his later years he was a Trustee of the Carnegie Institution of Washington, taking a very active part in its administration, and in 1931 was elected President of the National Academy of Sciences. This was a critical period in the life of the Academy, both financially and scientifically, and leadership less firm and wise than his during the next four years might well have been disastrous.

Dr. Campbell's brilliant achievements in astronomical research and his distinguished record as an executive and educator were accorded wide recognition. No less than five gold medals were awarded to him. Four American universities, as well as the University of Western Australia and Cambridge University, England, conferred upon him the honorary degree of Doctor of Science and two, Wisconsin and California, the honorary degree of Doctor of Laws. He was made Commander of the Order of Leopold II, Belgium Officer of the Legion of Honor, France, and Commander of the Order of the Crown of Italy.

He was appointed Silliman Lecturer at Yale in 1909-10, publishing the lectures in 1913 under the title of *Stellar Motions*; William Ellery Hale Lecturer before the National Academy of Sciences in 1914, and Halley Lecturer at Oxford University in 1925. He was also foreign associate or member of nearly all the leading astronomical societies and academies of science in Europe.

His friends recall gratefully these many tributes to his distinguished services to science and to education, but their memories dwell far more upon the man himself. They remember the jovial comrade on the tennis court and golf course and at the bridge table; the counselor, ever ready to give wise and unselfish advice and assistance to colleagues and students; the strong man standing firmly and unflinchingly by his principles, seeking not the easy

way to solve the problems of life but taking the one, however hard it might be, that he decided to be right. In his conduct of life his standards were as high as they were in his scientific and administrative work.

ROBERT G. AITKEN.

HENRY HERBERT DONALDSON

(1857-1938)

Henry Herbert Donaldson was the son of John Joseph and Louisa Goddard (McGowan) Donaldson. Both his parents were of Irish stock though both were born on this side of the Atlantic; his father was a native of New York where he was a successful banker; his mother was born in Montreal, Canada. She was a handsome woman, noted for her orderliness and great presence of mind, in which qualities her son resembled her. Both his parents lived to an advanced age, his father dying at 79 and his mother at 84; his grandparents also were equally long-lived. Their children were Henry Herbert, born at Yonkers, New York, May 12, 1857, and Alfred Lee, born in 1866. The latter like his father was a banker; he was also the author of a *History of the Adirondacks* and was something of a poet and musician. The elder son prepared for college at Phillips Academy, Andover, Massachusetts; he then entered Yale and was graduated in 1879 with the degree of Bachelor of Arts. His father had desired that his son should join him in business but yielding to the young man's preference for science it was agreed that he should enter the medical profession. In further preparation for medicine he spent an additional year at Yale working with Professor Russell H. Chittenden on the detection of arsenic in various organs of the body in cases of arsenical poisoning. The results of this year's work were published jointly with his professor as his first scientific paper.

During the year 1880-81 he attended the College of Physicians and Surgeons in New York but realizing that his interests were in research rather than medicine he accepted a fellowship in biology in the graduate school of Johns Hopkins University in 1881, which appointment he held for two years, specializing in physiology under Professor H. Newell Martin. As a result of this work he published four papers on physiology and pharmacology, two of them under joint authorship with other students.

After his two years as fellow he was appointed student assistant in the department of biology for the year 1883-84. At the close of this academic year he married Julia Desboro Vaux of New York and during the following year he finished his thesis for the doctor's degree under the direction of G. Stanley Hall who was at that time Professor of Psychology at Johns Hopkins, and was awarded the Ph.D. in 1885. His thesis was entitled "On the Temperature Sense" and concerned the mapping of heat-sensitive and cold-sensitive areas of the skin. During the following year he was Professor Hall's assistant and they completed and published jointly a paper on "Motor Sensations of the Skin."

His work on the sensory areas of the skin led him to seek more extensive training in neurology in European centers, and in February 1886, he, his wife and his father went abroad and remained until the autumn of 1887. During their year and a half abroad he studied under Forel at Zurich and von Gudden at Munich and visited the laboratories of Meynert, Golgi and von Monokow. At the close of this European visit he returned to Baltimore as Associate in Psychology at the Johns Hopkins University and this position he held from 1887 to 1889.

In 1888 G. Stanley Hall became President and Professor of Psychology in the newly founded Clark University at Worcester, Mass., and in 1889 Dr. Donaldson was called to Clark as Assistant Professor of Neurology. His proven ability in this field led President Hall to assign to him for study the brain of Laura Bridgman, a blind deaf mute who had been taught to speak and had attained marked mental ability. Parts of this long and detailed study were published in 1891 and 1892 and it has been characterized as "probably the most thorough study of a single human brain that has ever been carried out." Of this study Dr. Donaldson has written in a brief autobiographical note: "The chief modifications found in this brain were caused by an arrest of growth due to the destruction of the sense organs. This made it desirable to know the developmental state of the brain at the time of the destructive illness (two years). Such information was not in the literature. With the hope of contributing to fill this gap I arranged a program for the study of the brain (nervous system) from birth to maturity. In carrying out this plan quantitative methods were used and data on the size and weight of the parts and on the number of cells in them were especially considered."

This led him to that long, accurate, quantitative study of growth which was the main theme of his life work. He gathered together all the available material on the growth of the central nervous system and published it in a book entitled, *The Growth of the Brain: a Study of the Nervous System in Relation to Education* (Scribner, 1895).

He remained at Clark University until 1892 when he joined the migration of most of the faculty to the reorganized University of Chicago, where he became Professor of Neurology and was very active in the development of the scientific departments. From 1892 to 1898 he served as Dean of the Ogden Graduate School of Science of the University of Chicago. During this time a tubercular infection of the hip joint interrupted his work and left him permanently lame, but after a prolonged visit to Colorado he returned to his work with courage and determination and from 1898 until his death there was never a year when he did not publish one or more researches.

In 1905 ten professors of anatomy and zoology in leading universities were invited to serve as the Scientific Advisory Board of the Wistar Institute of Anatomy and Biology in Philadelphia, and on the invitation of the founder of the Institute, General Isaac J. Wistar, and of its Director, Dr. Milton J. Greenman, this Advisory Board met at the Institute in April, 1905 and was asked to propose a plan for the future development of the Institute. It was the unanimous opinion of the Board that the Institute should be devoted primarily to research and in the beginning to research in neurology. This met with the hearty approval of General Wistar, and the Board was asked to recommend some one to organize this work. Dr. Donaldson was the unanimous choice of all the other members and after long and serious consideration he accepted the appointment, and in the following year transferred his activities and his chief assistant, Dr. S. Hatai, from the University of Chicago to the Wistar Institute where he became Professor of Neurology and Director of Research.

While at Chicago Donaldson had published one book and seventeen papers, most of them on the human nervous system and that of the frog. However, his attention was called to the peculiar advantages of the albino rat as a laboratory animal in 1893 and Dr. Donaldson's associate, Dr. Hatai, had published fifteen papers based on the white rat before removing to Philadelphia. This work

on the rat convinced Donaldson that it was the best available mammal for laboratory work on problems of growth. In an autobiographical note he says: "I selected the albino rat as the animal with which to work. It was found that the nervous system of the rat grows in the same manner as that of man—only some thirty times as fast. Further, the rat of three years may be regarded as equivalent in age to a man of ninety years, and this equivalence holds through all portions of the span of life, from birth to maturity. By the use of the equivalent ages observations on the nervous system of the rat can be transferred to man and tested. The results so obtained show a satisfactory agreement and indicate that the rat may be used for further studies in this field."

For accurate quantitative studies of growth it was necessary to establish a standard stock and to get rid as far as possible of individual differences caused by peculiarities of heredity or environment. Accordingly he and his associates set about the problem of producing a pure bred stock raised under accurately controlled conditions which would give a standardized strain of laboratory animals. How well they succeeded in this is recognized throughout the world by the wide use in the most accurate work of the "Wistar Institute stock" of white rats.

This work on the standardization of a research mammal was summarized in 1915 in a book entitled *The Rat: Reference tables and data for the Albino Rat and the Norway Rat* (Memoir of the Wistar Institute). A revised and enlarged edition of this book was published in 1924. It may be said that this work renders a service in mammalian research comparable to that of pure chemicals in chemical research or to the *Tables of Physical Constants* in the physical sciences. Largely because of this work the albino rat has become the most widely used laboratory mammal. Another major work of 370 pages and 339 figures, many of them colored, on the *Anatomy of the Rat* was prepared by one of Dr. Donaldson's associates, Eunice Chace Greene, and published as Volume XXVII (1935) of the TRANSACTIONS of the American Philosophical Society.

The main theme running through the whole of Donaldson's work was organic growth. In his presidential address before the Association of American Anatomists in 1916-17 he said: "Were I asked to name some direction in which we might extend our work I should naturally lay weight upon post-natal growth in the terms of cell multiplication and cell structure, with its many subsidiary

problems." Much of this work was on the nervous system, but it was extended to include muscles, viscera, skeleton and teeth, both in normal and in experimental conditions. Several papers were on the number of nerve cells and fibers, others on the size of these, and many papers were devoted to the effects of exercise, feeding, castration and age on the size and weight of particular organs. The determination of the percentage of water in the central nervous system under all of the experimental conditions named constituted a large section of his work.

Altogether he personally published nearly one hundred papers and monographs on these subjects, and his students, assistants and associates published more than three hundred and sixty separate articles on these and related subjects. His method of directing the research work of associates is well described in his published report to the Scientific Advisory Board in 1925 (pp. 46-48): "No investigator is ever asked to do anything which is not for his individual and scientific welfare. For the most part those who come to the Institute are in the early stages of their scientific work and do not bring their problems with them. It is for us, therefore, to suggest one. . . . As an aid in obtaining orderly data which will interlock, the custom of dealing with papers used by the distinguished physiologist Carl Ludwig has been followed. The papers of the younger men have been in every case read critically by some member of the staff familiar with the field, with the new observations brought into relation with those previously published from the Institute. Such criticism assists the younger writer in several ways and also makes it possible to tie together the results of consecutive studies in a manner that gives them cumulative value. . . . In every case the investigators receive full personal credit for their work. This is as it should be, for it is the virtue of academic laboratories that the emphasis is put on the individual rather than on the institution."

His interest in and sympathy with all types of good scientific work were broad and generous. He had keen appreciation of good literature, music and the graphic arts. His concern with social problems and human welfare was deep and genuine, and even his closest friends never learned from him of his generous contributions and acts of kindness to those who were in need. His students and colleagues knew him as a man of infinite patience, even temper and nobility of character and they loved and honored him. Among

those who published work done in his laboratory were some thirty Americans, twenty Japanese and a smaller number of other nationalities; many of these persons are leaders in their professions and all of them revere his memory.

For his eminence in research he received the honorary degree of Sc.D. from Yale in 1906 and from Clark in 1937. He was elected President of the American Association of Anatomists for 1916-18, of the American Society of Naturalists in 1927 and of the American Neurological Association in 1937. He was elected to membership in the American Philosophical Society in 1906 and was a Councillor of the Society for four terms of three years each, namely, 1911-13, 1915-17, 1928-31, 1932-35; he was Chairman of the Committee on Publications from 1932 until his death and was instrumental in establishing the new series of MEMOIRS of the Society, and from 1935 until his death he was a Vice-president of the Society. He was a member of the Corporation of the Marine Biological Laboratory from its foundation in 1888 until his death and a Trustee from 1912 to 1929 when he became Trustee Emeritus. In 1911 he established his summer home at Woods Hole, Massachusetts, and every summer thereafter, with the exception of two when he was abroad, he carried on his research work there at the Marine Biological Laboratory. He was elected to membership in the National Academy of Sciences in 1914 and was a member of the Council in 1919. He was also an honored member of ten other American and foreign scientific societies. For twenty years he was President of the Lenape Club of the University of Pennsylvania and on the occasion of his eightieth birthday in 1937 a bronze portrait medallion of him, made by Dr. R. Tait McKenzie, was placed in the Club with appropriate ceremonies and a replica of the medallion now hangs in the hall of the American Philosophical Society.

His personal appearance was so distinguished that it always commanded attention and admiration. Any one who had once seen him could never forget his magnificent head, his steady sympathetic eyes, his gentle smile. With these were associated great-hearted kindness, transparent sincerity, genial humor. Perhaps his most distinctive personal characteristic was the quality which Sir William Osler celebrates in his essay, "*Equanimitas*." With this were naturally associated orderliness, persistence, serenity. His laboratory and library were always in perfect order, his comings and goings were as timely as the clock, he never seemed hurried and yet he worked "*Ohne Hast, ohne Rast*."

In 1884 he married Julia Desboro Vaux of New York, who died in 1904. Two children were born to them, John C. Donaldson, now Professor of Anatomy in the Medical School of the University of Pittsburgh, and Norman V. Donaldson, at present Secretary of the Yale University Press. In 1907 he married Emma Brace of New York and their hospitable homes in Philadelphia and Woods Hole were known to a host of loving friends.

After his long illness in the middle nineties of the last century he was never in robust health, but was almost never incapacitated for his regular work. Until a few days before his death he was at work as usual in his laboratory at the Institute. His end came as a result of pneumonia and heart failure at his home in Philadelphia on January 23, 1938, in his eighty-first year. With characteristic foresight he and Mrs. Donaldson had sometime before planned the simple and appropriate funeral service which should be held in the event of either's death. His pallbearers were chosen from among his scientific associates and the officers of the Institute, the University of Pennsylvania and the American Philosophical Society. His brain was preserved and added to the notable collection at the Wistar Institute and his body was cremated. His work, influence and memory remain to make the world richer for his having lived in it.

EDWIN G. CONKLIN.

EDWARD MURRAY EAST

(1879-1938)

In the death of Dr. East our Society has lost a member in whom our founder, Benjamin Franklin, would have taken delight, for East in a busy life contributed actively to the increase of useful knowledge both theoretical and applied. He was born in Du Quoin, Illinois, on October 4, 1879, and died in Boston, Massachusetts, on November 9, 1938. His collegiate education was received at the University of Illinois, where he obtained the bachelor's degree in 1900 and the degree of Ph.D. in 1907. In the intervening years he served a rigorous scientific apprenticeship in helping to carry out a breeding experiment with maize, the most important field crop of the corn belt. Its object was to increase by selection the protein content of maize and so its nutritive value. Several years later East was able to point out the futility of such selection experiments,

since they contravene the pure line principle established about this time by the experiments of Johannsen on garden beans. But at the time and by those who planned the experiments selection was thought to be without limitation in its capacity to effect organic changes.

This experience was an important part of East's training in the methodology of science, and it left him a skilled technician as well as a keen critic of the adequacy of scientific evidence.

In 1905 he was appointed agronomist in the Connecticut Agricultural Experiment Station at New Haven. Here he remained four years and began his long and fruitful career as an independent investigator. He was fortunate in the time and place of the undertaking. The fundamental law of heredity, Mendel's Law, had recently been rediscovered and it was clear to East that in this, rather than in the selection of minute quantitative variations in which he had been engaged in Illinois, lay the road to the direct and permanent improvement of farm crops. The mutation theory of DeVries, which had recently been announced, pointed out the true source of heritable variations, and Mendel's Law showed the manner of their transmission and recombination.

So much for the time when East began his independent work, its place was equally fortunate, under the inspiring shadow of Yale University, and in a little band of such eminent experimenters as Osborne and Mendel, where Thaxter had recently worked before his transfer to Farlow's laboratory in Cambridge. East was to follow Thaxter to Harvard University four years later, but for the time being he organized at New Haven an attack on the problem of improving the major farm crops of Connecticut, maize and tobacco, utilizing the newly discovered principles of mutation and Mendelism. His success was immediate and complete. A bulletin which he prepared describing his initial experiments and outlining the correct procedure to be followed in crop improvement in the light of newly discovered principles, was well received and brought him an invitation to become connected in 1909 with Harvard University, where his major life work was accomplished.

East did not terminate his work in Connecticut on his transfer to the Bussey Institution at Harvard. Under a generous plan of cooperation between the Connecticut Agricultural Experiment Station and Harvard University, he continued for many years to direct and supervise the work of crop improvement of corn and

tobacco in Connecticut, the breeding experiments being in immediate charge of a succession of able assistants who spent their summers in the experimental field plots in Connecticut and their winters in East's laboratory and greenhouses at Forest Hills, analyzing the results of their summer's work or making intercrop experiments in the greenhouse.

East's fundamental discoveries in the field of heredity while connected with Harvard University from 1909 to 1938 received world wide recognition and brought him graduate students from all parts of the United States, and from many foreign countries, particularly Japan and Germany. Among the more than twenty students who received the doctor's degree under his guidance were several who have already attained an eminence scarcely second to his own, such for example as R. A. Emerson, Karl Sax, D. F. Jones, R. A. Brink, and Edgar Anderson.

Since East was working in a new and rapidly developing field of knowledge, it is not surprising that his discoveries were often made simultaneously though independently of similar findings by others. Thus he shares with G. H. Shull credit for the discovery of the important principle of heterosis or crossbred (hybrid) vigor in maize, and with Nilsson-Ehle credit for the discovery of the principle of multiple factors in heredity. What was probably his most original discovery relates to the nature and mode of inheritance of self sterility and cross sterility in plants, but there are few aspects of the science of plant breeding to which he did not make important contributions. One of the greatest was his classic study made, under joint authorship with his pupil, D. F. Jones, on *Inbreeding and Outbreeding*.

The breadth of his interests took him into the field of eugenics where he published popular books widely read concerning the problems of world population and food supply in relation to agriculture, under the titles *Mankind at the Cross Roads*, and *Heredity and Human Affairs*.

East was of medium stature, possessed of keen and penetrating intelligence, and with a wide range of interests. He had strong likes and dislikes and was outspoken in expressing them, but he had also a strong capacity for friendship and was a lover of the best things in literature and art as well as in everyday life. He was always interested in promising young men and sought to aid in their advancement. In our Society, to which he was elected in

1916, he was particularly active in trying to secure candidates for membership who gave promise of adding to knowledge, and his advice was helpful. He was an ornament to our membership.

W. E. CASTLE.

JOHN MARSHALL GEST

(1859-1934)

John Marshall Gest, lawyer, judge, scholar and author, was born in Philadelphia March 17, 1859. He lived his whole life in the city which he loved and served and died there on November 30, 1934.

He was the son of John Barnard Gest and of Elizabeth Ann (Purves) Gest. He matriculated in the College of the University of Pennsylvania in 1875, from which his father had graduated in 1844. His intellectual activities while an undergraduate were a fitting prelude to his achievements in later life. In each of his four years he won honors of the first grade, took the degree of A.B. at the head of his class in June of 1879 and was awarded his M.A. three years later. Upon entering college and during his freshman year he took prizes for work in Greek. In junior and senior years he won other prizes in the same field of study and as a senior was awarded the Latin Prize and the Latin Essay Prize. During his course he had likewise taken a prize for the Solution of Geometrical Problems and upon graduation he was Latin Salutatorian at Commencement. That he was no mere "grind" is indicated by his choice as "Spoon Man," an award that marked him as the most popular man in his class.

In the Law School of the University of Pennsylvania he made another notable record and upon graduating in 1882 was awarded the Sharswood Prize for his essay on "The Rule in Ex Parte Waring." At the bar he quickly won recognition, practising almost exclusively in the court of which he was destined later to be a distinguished member. From time to time he wrote and published learned monographs and delivered thoughtful addresses on subjects related to the law. At least sixteen of these literary efforts were afterward published and were widely read by the profession. His book on *Practical Suggestions for Drawing Wills and the Settlement of Estates in Pennsylvania* quickly took high rank among legal text-books.

When in 1911 that distinguished judge, the Honorable Clement B. Penrose, was about to retire from the Orphans' Court of Philadelphia County, he wisely and effectively used his great influence to bring about the appointment of John Marshall Gest as his successor. The appointment aroused great enthusiasm at the bar, was heartily welcomed by the sitting judges and was thrice ratified at the polls for ten-year terms expiring respectively in 1911, 1921 and 1931.

He discharged his judicial duties with characteristic thoroughness. The quickness of his apprehension, his keen sense of justice, his mastery of the precedents and the urbanity with which he treated all who came before him made practise in his court a delightful experience. His opinions are models of clarity and precision. They rank with the best work of probate judges whether in this country or in England. He was ready to respond to calls for public service. Perhaps the most important of his contributions in this field was the work which he did as a member of the commission appointed to draft the seven statutes which now constitute the body of the law of Decedents' Estates in Pennsylvania. He was elected a Trustee of his University in 1919 and saw eight years of active service. He resigned only when ebbing physical vigor made the step necessary. His Alma Mater conferred upon him in 1930 the honorary degree of Doctor of Laws.

In 1921 he was honored by election to the American Philosophical Society and took both pride and pleasure in his membership. Had he produced no other scholarly work than that remarkable volume entitled *The Old Yellow Book* he would have deserved recognition by this or by any other learned society in the world. He had long felt a scholar's interest in the source of Browning's *The Ring and the Book*, but it was the publication by the Carnegie Institution of Professor Hodell's reproduction of the ancient volume and his translation of it which stimulated John Gest's interest and led him to undertake his formidable literary task. To the investigation of the mystery which Browning had immortalized John Gest brought his wealth of scholarship, his capacity for painstaking research, his rich store of legal learning and his highly developed historical sense. It has been estimated by competent authority that in the course of this investigation he read over three thousand books, many of them in medieval Latin, in the translation of which he was an adept. Not satisfied with Hodell's translation of the documents

constituting the *Yellow Book*, he proceeded to make one of his own. To this he added his comments upon the facts and the law of the case and an acute criticism of Browning's treatment of them. He made enlightening notes on the latinity of *The Old Yellow Book* and a glossary of words unusual in themselves or employed with unusual meanings. To this he added a translation of the celebrated argument of Farinacius in behalf of Beatrice Cenci, which is several times referred to by counsel in *The Old Yellow Book*. The sum total of these labors is a remarkable contribution to the literature of the law and an enduring testimony to the rare combination of qualities which alone made such a work possible. That John Gest was able to make a whimsical comment upon his own achievement is indicated by the following passage in the Introduction:

"The book has been written at odd times, and in the intervals of pressing duties, and it has cost me an immense expenditure of time and trouble, particularly as I was obliged to collect a special library of many hundreds of volumes, containing the medieval and post-medieval Continental criminal law. Perhaps my pains have been wasted, and very probably might have been more profitably bestowed on other things. I might even have learned to play Bridge, or contracted Golf, which is a disease rather than a game. Yet as Browning himself put it, reminiscent of classical phrase and medieval legend:

'the very fiends weave ropes of sand
Rather than taste pure hell in idleness.'

But I did not choose to write this book, it chose me. As Samuel Butler said (not the Hudibras man, but the S. B. who wrote *Erewhon*), 'Only do that which insists on being done, and runs right up against you, hitting you in the eye, until you do it. This calls you, and you had better attend to it, and do it as well as you can.'"

At the end of his introduction occurs a passage which deserves quotation here because it discloses what manner of man he was.

"And now," he wrote, "as my work is ended, and I look up at the shelves on which repose the tomes of Farinacius, Clarus, De Angelis, Hippolytus de Marsiliis, and the other great criminalistae—those quaint and curious volumes of forgotten lore, whose authors have rested from their labors centuries ago, I can almost fancy that I see the shades of Hyacinthus de Archangelis and Desiderius Spretus, of Joannes Baptista Bottinius and Franciscus de Gambis, and eke of Antonius Lamparellus, foregather in my study to bid

me farewell who have lived with them so long. I have learned to like these men. They were not slothful in business, they were fervent in spirit, if not serving the Lord, at least serving faithfully their clients. I would welcome their ghostly visitation. I would, if I could, ask them to explain certain puzzling passages in their arguments, and sundry fine points of law, but more than all else I would like to read them what Browning and certain English and American critics have said about Caponsacchi 'the chivalrous priest,' and Pompilia, 'the star of purity,' 'so sweet and true and pure and beautiful.' I would ask them in Horatian phrase:

Risum teneatis amici?

And they would answer in the words of the same poet:

Solventur risu tabulae."

Limits of space forbid an adequate comment upon John Gest's personal qualities and upon the singular happiness of his family life. Suffice it to say that because of what he was every man in the great circle that came within the sphere of his influence found a firmer faith, a higher respect for the judicial office and a clearer perception of the dignity of the human soul. As was said by one of the speakers at the bar meeting held in his honor: "Such men do not die. They live on in the collective memories of the profession. Their lives become part of the notable tradition of the Bench and Bar of Philadelphia."

GEORGE WHARTON PEPPER.

GEORGE ELLERY HALE

(1868-1938)

George Ellery Hale was born in Chicago, June 29, 1868, and died in Pasadena in his seventieth year on February 21, 1938. Throughout his entire life his intense desire for superior instrumental equipment, combined with a rare technical ability, resulted in the production of the largest astronomical instruments in the world and earned for him the title "greatest builder in American astronomy." Even during his college days at the Massachusetts Institute of Technology, from which he received the degree Bachelor of Science in 1890, he was engaged in the development of the spectroheliograph. With his new instrument his first successful photographs were obtained on April 14, 1890, at the Harvard College Observatory where he was a volunteer assistant.

Following his graduation from college Hale returned to Chicago and in 1891 established there the Kenwood Observatory, later merged with the Yerkes Observatory. In 1892 the University of Chicago made him Assistant Professor of Astrophysics in recognition of his already important contributions to solar physics; in 1897 he was given a professorship. Shortly after his appointment in the University an opportunity was presented for the purchase of glass blanks of forty inches diameter. Hale received the backing of Mr. Yerkes, a railroad magnate, and had the glass fashioned into the forty-inch lens, the world's largest. To permit the most efficient use of the great telescope which the lens made possible, the Yerkes Observatory was constructed. Between 1895 and 1905 Hale was the director of the Observatory. His influence and enthusiasm resulted in the founding in 1892 of the magazine *Astronomy and Astro-Physics* which in 1895 was transformed into the *Astrophysical Journal*, an international journal devoted to astrophysical papers. Throughout his entire life Hale remained one of the editors of this important technical magazine.

In 1904 a joint experimental station was established on Mount Wilson in southern California by the Carnegie Institution and the Yerkes Observatory. For several years Hale had been interested in the construction of a reflecting telescope of five-foot aperture which would be used in conjunction with the great Yerkes refractor. His successful investigations on Mount Wilson convinced the Carnegie Institution that this large telescope was essential and they soon established a permanent observatory on the mountain and sponsored the construction of the five-foot reflector. To take over the directorship of this new observatory Hale resigned his position with the University of Chicago in 1905 and moved to Pasadena. In 1906 plans were formulated for the construction of a reflector of one hundred inches aperture and despite the numerous difficulties presented by this task, the telescope was completed during the war.

To aid in his solar studies Hale conceived the tower telescopes, and with these tremendous instrumental resources at their command he and his associates discovered and studied the magnetic fields of sunspots, the bipolarity of spot groups, the reversal of the polarities with the eleven-year sunspot cycle, and the weak general magnetic field of the sun. In 1923 failing health caused him to resign the active directorship of the Mount Wilson Observatory and to retire to his private observatory in Pasadena. Here he continued to work,

investigating the strength of the sun's general magnetic field and again developing a new instrument, the spectrohelioscope, for the visual study of the sun's surface. During these years he was a leader in the project for the construction of the two-hundred inch telescope which, when completed, will be another evidence of his ability to plan great instruments, capable of construction and nicely suited to the problems in mind.

In 1904 Hale was instrumental in the formation of the International Solar Union of which he was elected the first President. The National Academy of Sciences also captured his interest; he served for eleven years as the Foreign Secretary and led in the instigation of the publication of its *Proceedings*. He was also active in the establishment of the National Research Council, the International Research Council, the International Council of Scientific Unions, and the International Astronomical Union. He was elected to the American Philosophical Society in April, 1902, was Councillor from 1913 to 1915 and Vice-president from 1917 to 1921. In addition to holding many offices in scientific societies, Hale was honored numerous times by organizations throughout the world. He received thirteen medals from scientific societies in addition to being honored by the governments of Italy and Belgium. Membership in forty-two scientific societies in all parts of the world attests his wide recognition. In addition he received twelve honorary degrees, principally from the world's largest universities. Not only in scientific affairs was Hale an important figure. He greatly influenced the development of the California Institute of Technology, was a Trustee of the Huntington Library and Art Gallery, and served long on the Planning Commission of the City of Pasadena.

Throughout his entire life Hale exhibited a great capacity for recognizing the important problems and for the construction of instruments by which their solution could be accomplished. His personal charm combined with his numerous talents made him a natural leader who could see the way ahead. As a builder and one of the founders of astronomy in the United States he will live on in the work of his associates and his observatories.

FLETCHER G. WATSON, JR.

ARTHUR H. LEA

(1859-1938)

Arthur H. Lea, A.B., L.H.D., was born in Philadelphia, September 17, 1859, and died January 8, 1938.

He was elected a member of the American Philosophical Society in 1912, being the third generation in his family to obtain the honor of membership in this Society. His grandfather Isaac Lea, one of America's great naturalists, was admitted to membership April 18, 1828, and served as Curator, Councillor, and Vice-president; his portrait graces the Hall of the Society. His father, Henry Charles Lea, was a distinguished historian. He was elected to membership in the Society April 18, 1867, being considered "one of the first great modern scientific historians." His portrait fittingly balances that of his father in the Society's Hall.

Arthur H. Lea received his early education at St. Paul's School, New Hampshire. Upon graduating he entered the Class of 1880 at Harvard University where he was graduated with honors as Bachelor of Arts.

In 1885 he became associated with the firm of Lea Brothers and Company, well known publishers of medical books and journals, the direct successor of the firm of Mathew Carey established in 1785, the founder of which, Mathew Carey, was a member of the American Philosophical Society. This firm has adopted the motto "*Quae prosunt omnibus*" which proved to be a fitting maxim for successive members of the firm, including Arthur H. Lea, who took an active part in "those things which benefit all."

In order to devote more time to public and charitable interests, on January 1, 1915, he retired from the firm which was then known as Lea and Febiger and broadened his interest and usefulness by adding to the duties devolving upon the President of the Board of Trustees of the First Unitarian Church, an active participation on the Boards of such organizations as the Visiting Nurse Society, the Civic Club, the Children's Hospital, the American Red Cross, the Historical Society of Pennsylvania, the Board of Governors of the Philadelphia Forum, and the Pennsylvania Academy of the Fine Arts, of which at one time he was President. The only business connection he continued was that of Director of the Fidelity-Philadelphia Trust Company.

In recognition of his interest and assistance to such organiza-

tions, Dickinson College conferred upon him, in 1933, the degree of L.H.D.

In the American Philosophical Society, to which he was elected on April 1912, his primary interest was the Committee on Publications. He was appointed a member of this Committee in 1914 and became Chairman in 1922.

He was a quiet retiring man with a knowledge of many subjects and with a keen interest in his fellow men. One of his chief characteristics was the thoroughness and care with which he considered the problems of the organizations with which he was associated. He was a man who carefully considered and planned his life, and when the time came and he thought it proper to retire from active business and devote himself to public interest, he took the step which so many others defer taking. What he practiced during his life he carried out at his death by leaving his fortune, in addition to certain pecuniary bequests, to many charities and providing that the residue be divided between Harvard University, the University of Pennsylvania, and the Children's Hospital.

MARSHALL S. MORGAN.

EDWARD MARTIN

(1859-1938)

Dr. Martin was born in Philadelphia in 1859 and attended Swarthmore College, where he received an A.B. degree (1878) and an A.M. (1882). He graduated from the School of Medicine of the University of Pennsylvania in 1883.

For a few years he practiced medicine and then devoted his time to the lines in which he ultimately specialized—genito-urinary and general surgery. He was a prolific writer, being the author of several authoritative textbooks on surgical subjects, editor of the *University Medical Magazine* and surgical editor of *The Therapeutic Gazette* as well as of innumerable papers read before various medical societies and associations.

He was a member of the Board of Managers of Swarthmore College from 1885. In 1902 he was elected Clinical Professor of Surgery at the Women's Medical College of Pennsylvania resigning after several years. He was Professor of Clinical Surgery at the University of Pennsylvania from 1903 to 1910 and John Rhea Barton Professor of Surgery from 1910 to 1918. He also served

the University of Pennsylvania as Professor of Surgical Physiology. He was chief surgeon to the University of Pennsylvania and Howard Hospitals, and consulting surgeon to Bryn Mawr Hospital, Norristown State Hospital for the Insane, State Hospital for the Insane at Wernersville and the Philadelphia General Hospital.

Dr. Martin was a Fellow and Regent of the American College of Surgeons, and a former President of the Clinical Congress of Surgeons, American Surgical Society, Clinical Society of Surgeons, American Association of Genito-Urinary Surgeons and of several foreign surgical societies as well as local state and county organizations. He was elected a member of the American Philosophical Society in April, 1933. In 1919 he received the degree of LL.D. from the University of Pennsylvania. In 1920 Swarthmore College and in 1935, Temple University conferred on him the degree of Sc.D.

When the World War involved the United States, Dr. Martin was chosen to be the Director of Base Hospital No. 20 of the University of Pennsylvania; however, he was soon called back to Washington. Dr. Martin was in the 364th Medical Regiment, O.R.C., U. S. A., and was honorably discharged from the service on January 28, 1919.

He was interested in many public enterprises and while State Commissioner of Health in Pennsylvania, it was due to his efforts that traveling dental and prenatal clinics were instituted, that special work regarding syphilis and gonorrhea was advanced, that the use of toxin-antitoxin for pre-school age children and of antitoxin early in diphtheria was begun; the Red Cross Christmas Seals sold for the benefit of the tuberculous poor by the Health Council in Philadelphia owes its beginning to Dr. Martin's efforts and interest. He also served as Director of Public Health and Charities and was on the Board of Education since 1911, being President at the time of his death. The new building for the biological sciences at Swarthmore College which was dedicated in 1937 was named in his honor.

WILLIAM PEPPER.

EDWARD LEAMINGTON NICHOLS

(1854-1937)

The death of Edward Leamington Nichols at West Palm Beach, Florida, on November 10, 1937, removes from the academic world one of those pioneer scientists who helped to lay the foundations of our present day universities with their varied activities in both research and teaching.

Nichols was born in Leamington, England, on September 14, 1854, of American parents temporarily living abroad. He entered the College of Arts and Sciences of the then young Cornell University in the fall of 1871 and received the B. S. degree in 1875. Following the custom, even necessity, of those Americans of that period who wished to continue academic studies beyond the bachelor's degree, he went to Germany and studied successively at Leipzig, Berlin and Göttingen, from the latter of which he received the doctorate in physics in 1879. It was during this period that he received a training and inspiration which was to dominate his entire life and to cause him to devote so much of his energies to research.

Returning to America, he held a fellowship at Johns Hopkins University during the year 1879-80. Here he made the intimate acquaintance of another of the pioneers in physics, Henry A. Rowland. The next year he was an assistant to Thomas A. Edison in his then new Menlo Park Laboratory, working on the incandescent lamp. He set up and put into operation one of the very first commercial photometers for incandescent lamps; and by his association with Edison, acquired a lifetime interest in the general problem of illumination. His many contributions in the succeeding decades to the scientific and practical aspects of illumination were recognized by the Illuminating Engineering Society which, upon Nichols' retirement from active service about 1919, bestowed upon him the rare distinction of Honorary Member, of which class of members there was at the time only one other, namely Thomas A. Edison.

Nichols' fundamental instincts, however, led him unerringly toward academic life. Following the year in Edison's laboratory, he was Professor of Physics and Chemistry at the University of Kentucky from 1881 to 1883. At the close of this two year period, he was appointed Professor of Physics and Astronomy at the University of Kansas, which post he held from 1883 to 1887. In 1887,

he was called to the Chair of Physics of Cornell University, where he remained until his retirement in 1919, when he was appointed Professor Emeritus by the Trustees of Cornell.

No brief sketch can begin to tell the whole story of the life and work of this great American scientist. Only those of us who had the rare privilege of working under and with him, thereby coming to know Nichols the man as well as Nichols the scientist, can appreciate his greatness, both of character and of achievement.

First of all, Nichols was an indefatigable researcher. His first paper "On Change of Volume of Liquids by Absorption of Gases," published in the *Annalen der Physik* in 1877, jointly with J. J. Mackenzie, was the result of work done at the University of Berlin. His last paper "On the Hydrogen Effect in Certain Oxides" was published in the *Journal of the Optical Society of America* in 1936. During this period of 58 years, Nichols published 179 papers in the scientific journals of the world; and in addition some nine books, miscellaneous articles, and reports of technical committees. In only six years of this span of over half a century do we find no titles listed. The first of these omissions, namely 1882-1883, was when he was changing from the University of Kentucky to the University of Kansas; the next, 1888, was when he was beginning his professorship at Cornell. The last three, 1931, 1934 and 1935, were during his declining years, more than a decade following his retirement from active service. Of these 179 papers, 33 were published after he became Professor Emeritus in 1919. Seldom do we find a career in research extending over so long and so fruitful a period.

Although the subjects to which Nichols devoted his attention cover almost the entire range of the physics of his generation, we nevertheless find a distinct thread of continuity running through his entire work. This thread starts with his doctor's thesis at Göttingen, the title of which was "The Light Radiated by Glowing Platinum." This work introduced him to the spectrophotometer, an instrument to the development of which he made many contributions and which, particularly in his later work in fluorescence and phosphorescence, he used with rare skill. Thus we find him at the University of Kansas in 1884 reporting "A Spectrophotometric Study of Pigments"; in 1889 at Cornell, "A Spectrophotometric Comparison of Sources of Artificial Illumination"; in 1891, "On the Influence of Temperature on the Color of Pigments." And

then began his work on luminescence which in large measure dominated his interests for the rest of his life. Notable in this field is the series of papers, jointly with Professor Ernest Merritt, entitled "Studies in Luminescence." The series contains 16 papers, all published in the *Physical Review* from 1904 to 1911, and deals with phosphorescence and fluorescence and the effect of temperature on these phenomena. Many other papers on light and luminescence generally appeared not only during this period but in subsequent years. Nichols was fascinated by this whole group of phenomena. At one time he remarked that if by some superhuman effort it should ever happen during his lifetime that all the phenomena of luminescence were discovered and understood, he would be very sad indeed, for that would make impossible "the great fun of research" in a field to which he had devoted so much of his life.

Although Nichols will be known to future generations of scientists largely because of his work in luminescence, there were other branches of physics to which he directed his attention, particularly in his earlier years. Following his paper with Mackenzie, mentioned above, he published several other papers on the expansion of liquids and solutions. During his Professorship at Kansas, he worked in collaboration with others on the effect of a magnetic field on chemical phenomena. In 1887, he read a paper before the Kansas Academy of Science, jointly with the late W. S. Franklin, "On the Destruction of the Passivity of Iron in Nitric Acid by Magnetization." His second published paper was on "A New Explanation of the Color of the Sky." He continued work on this subject at intervals. His investigations culminated in a spectrophotometric study of the color of the sky in many places in Europe and Africa, made while on sabbatic leave during the second term of 1907-08. In the bibliography of his works we also find papers on photometry, electrical resistance, measurement of high temperatures, color blindness and other subjects.

In evaluating Nichols' contributions to the science of physics, one is impressed by the fact that of even greater importance than his 179 papers is the influence which he exerted on research in American institutions. When Nichols began his academic career, American colleges and universities offered little in the way of instruction and opportunity for study beyond the conventional bachelor's degree. Nichols and the scientists of his generation brought

back from their studies in Europe a conviction that American higher education could be successful only if research was not only permitted but indeed regarded as a part of the professor's duties. It was this philosophy which Nichols always taught, perhaps more by example than by precept. If, as seems to be generally accepted, America leads the world in scientific research today, it is due in very large part to the emphasis which Nichols and his colleagues laid upon the importance of research.

It was this urge to build up American science which led Nichols to found the *Physical Review* under the sponsorship of Cornell University in 1893. For 20 years he was its editor-in-chief. He was one of the leaders of the small group of physicists who founded the American Physical Society in 1899. In less formal but perhaps more important ways, he inspired those students who came under his influence to careers in research. The great majority of that large number of graduate students and instructors who came in contact with Nichols during his 32 years as Director of the Department of Physics at Cornell University, have retained their interest in and devotion to research in physics, in many cases along lines to which Professor Nichols himself devoted so much attention.

Nichols' honors were many. He was a member of the American Philosophical Society, elected in April 1904 (Councillor, 1910-12); of the National Academy of Sciences; and of the American Academy of Arts and Sciences. He was president of the Kansas Academy of Sciences in 1884-86; of the American Association for the Advancement of Science in 1907; of the Society of Sigma Xi in 1907-08; and of the American Physical Society in 1908-09. He was elected to honorary membership in the American Institute of Electrical Engineers, the Illuminating Engineering Society and the Optical Society of America.

The work of Nichols the scientist will live in the literature of physics for generations to come. Less tangible but perhaps of more importance, is the work of Nichols the man. At the time of his retirement from active service in 1919, the heads of the departments of physics in 35 colleges, 15 of them state universities, were men who had received their training under him. To this list must be added the large number of his students who hold important posts as college teachers or as workers in government and industrial laboratories.

A very large number of these former students gathered at Cor-

nell University in June 1919 to do honor to Nichols at the time of his retirement from active service. Upon this occasion President Schurman of Cornell University remarked, "If we had to count on the fingers of one hand the ablest teachers which Cornell University has ever had, Professor Nichols would count among the number." And Dean Thilly of the College of Arts and Sciences of Cornell University, in closing his remarks, said, "If we keep before us the image of Professor Nichols and his ideals we shall always remain loyal to the spirit of academic freedom which constitutes a real university." The secret of Nichols' success, of his genial personality, modesty and simplicity, and of his splendid influence upon his colleagues and students, is perhaps contained in one sentence from his extemporaneous remarks in acknowledging these tributes from his friends: "It has been delightful, indescribably delightful, that life which comes from the study of science."

F. K. RICHTMYER.

LORD RUTHERFORD OF NELSON

(1871-1937)

It has become customary to date the beginning of the modern period in physics with the year 1905; for it was in December of that year that Roentgen announced his discovery of x-rays. This discovery was unique in history in the immediacy with which it stimulated men the world over to start off on new types of investigations of extraordinary fruitfulness. The words "electronics," "radioactivity," "atomic structure," "quantum theory" call up vast fields of modern knowledge, all of which have been created *in toto* since 1895. For the significance and multiplicity of their contributions to these fields the names of two men stand out above all others. They are the names of Rutherford and Bohr. It is for the first of these that the sad duty is now assigned of writing an obituary notice for the YEAR BOOK of the American Philosophical Society.

So fruitful has he been that the period of modern physics might have been defined as the period of his active life, for it was in the fall of 1895 that, at the age of twenty-four, he appeared in Cambridge on an "1851 Exhibition Scholarship" from New Zealand, the first research student, as J. J. Thomson has said, to come to study with him at the Cavendish Laboratory. He brought his

problem with him for he had already written two papers for *The Transactions of the New Zealand Institute* on (1) "Magnetization of Iron by High Frequency Discharges" and (2) "Magnetic Viscosity." At the Cavendish Laboratory he continued his work on magnetic detectors of Hertzian waves¹ and in the latter part of his three-year stay there he joined in the investigations led by J. J. Thomson on "The Conduction of Electricity through Gases," making one of the very early determinations on ionic mobility in gases and also on the rate of recombination of gaseous ions. There is a very characteristic Rutherfordian remark that dates from this period, namely: "Ions are jolly little beggars, you can almost see them."

But it was after he went to McGill University where he was appointed in 1898 as Research Professor of Physics in succession to H. L. Callendar that he really struck his stride and did the first of his three great pieces of work, perhaps the greatest of them all. For although Becquerel discovered radioactivity in 1896 and Madame Curie brilliantly separated radium and polonium in 1898 and a large mass of observational data was collected by workers in many laboratories it was after all the genius of Rutherford that first in 1902 began to set forth a general theory of spontaneous atomic disintegration and radioactive change and with consummate skill mastered the whole radium family and fitted every one of its eight members into its correct place in the line of descent. His Bakerian Lecture² is a masterpiece seldom equalled anywhere in the history of science. By the time he left McGill University in 1907 he had published between forty and fifty papers. In 1904 he was elected a member of the American Philosophical Society, and in 1906 at the Franklin Bicentennial Celebration he delivered one of the principal addresses on "The Modern Theories of Electricity and Their Relation to the Franklinian Theory."³

Rutherford's Manchester period was from 1907 to 1919, and here he became the leader of a great school with men like Moseley and Bohr and Griger and Marsden and Darwin and Robinson in it, but he kept up his personal experimental and theoretical work and brought forth his second great contribution in the nuclear atom in 1911. This cleared up another field in which physicists had been messing around futilely for a dozen years.

¹ *Phil. Trans. A*, Vol. 198, p. 1, 1897.

² *Phil. Trans. A*, Vol. 204, pp. 169-219, 1904.

³ *Franklin Bicentennial*, Vol. 1, pp. 123-157.

The War scattered the workers and took Rutherford himself in 1917 to America on the Allied scientific mission. In 1919 he became the Director of the Cavendish Laboratory and held the post until his death in 1937. In this period he personally brought forth the first direct experimental evidence for the possibility of the artificial transmutation of the elements in the proof that the proton can be knocked out of a whole series of elements by bombarding their atoms with alpha particles. As a young man in New Zealand he had read a paper to the "Science Society" (1891) on "The Evolution of the Elements." In his second Bakerian Lecture of 1920 on "The Nuclear Constitution of Atoms" he showed how the first great step in the artificial transmutation of the elements had been made.

Personally Rutherford was a genuine, kindly and friendly man beloved and admired by all who knew him. His coming brought in a great period in physics. Will his passing end one?

ROBERT A. MILLIKAN.

GEORGE E. DE SCHWEINITZ

(1858-1938)

On August 22, 1938, the world lost one of its outstanding leaders in medical science through the death of Dr. George Edmund deSchweinitz. He died at his home in Philadelphia at the age of 79. For fifty years he was the most widely known and the most erudite American Ophthalmologist, and he well deserved the title with which he was acclaimed both here and abroad—the Dean of American Ophthalmology.

He was born in Philadelphia on October 26, 1858, the son of Edmund deSchweinitz, a Bishop of the Moravian Church, and Lydia deSchweinitz. His ancestry goes back to Moravian nobility, and his family tree, like that of many of our eminent thinkers, contains a relatively large number of prominent men in many different fields of endeavor.

Of his early life we know little, save that his father, the Bishop, was able to give him an excellent intellectual start, but had hardly sufficient funds to contribute to his medical education. A legacy had been left to the son by a grandmother, but this was small, so for two years he added to his worldly wealth as well as to his mental equipment by teaching school at Nazareth Hall. This may have contributed somewhat to his ability in teaching later on.

He attended the Moravian College in Bethlehem, Penna. and received the Bachelor of Arts Degree in 1876. Two years later he received the graduate degree of Master of Arts from the same institution and then began his medical instruction at the University of Pennsylvania. He distinguished himself immediately as a student and as a leader, and was the first honor man in his class and was elected the class president.

He probably had no thought at this time of entering the specialty of diseases of the eye, for after his graduation he was appointed an intern at the Children's Hospital for one year and later an intern at the University Hospital, from 1881 to 1883. He then became quiz master in therapeutics, and from 1883 to 1888 he served as prosector of anatomy under Dr. Joseph Leidy, who was then Professor of Anatomy. It is said that he might have selected general surgery, for his preceptor, Dr. Wharton, was a surgeon, and for a brief period Dr. deSchweinitz held the position of surgical registrar at the University Hospital.

Fortunately for the science of Ophthalmology his ability was recognized by Dr. William F. Norris, who was then the first Professor of Ophthalmology at the University of Pennsylvania, and he was persuaded to begin the study of this special branch of medicine under Dr. Norris' direction. In 1885 he was elected ophthalmic surgeon to the Children's Hospital, and the following year he received the appointment of Ophthalmologist to the Orthopedic Hospital and Infirmary for Nervous Diseases, where he was associated with Dr. S. Weir Mitchell. In 1887 he was appointed an ophthalmic surgeon to the Philadelphia General Hospital, and in 1891 he was made Professor of Ophthalmology at the Polyclinic and College for Graduates.

During this period he attended Dr. Norris' clinic as well, but in 1892 he resigned to become Clinical Professor of Ophthalmology at the Jefferson Medical College. Four years later he was appointed Professor of Ophthalmology at this institution. He did not return to his original University circles until 1902, when he succeeded Dr. Norris as Professor of Ophthalmology. In 1888 he was elected one of the editors of the University Medical Magazine, and served in this capacity first with Dr. Hobart A. Hare and later with Dr. Edward Martin. These men became two of his closest friends throughout their lives.

For twenty-two years he held the Chair of Ophthalmology at

the University, retiring in 1924 because of the age limit. He was then elected Emeritus Professor of Ophthalmology.

His contributions to medical literature were voluminous, and all were marked by a clarity of thought and style which makes them masterpieces of medical writing quite apart from the scientific value of their contents. Many of his papers are considered today the finest descriptions of the diseased conditions in any language. His researches in his chosen field were awarded prizes in this country and in Europe. He was the recipient of the Alvarenga Prize in 1894, awarded by the College of Physicians of Philadelphia, for his essay on the "Toxic Amblyopias," and of the Bronze Plaque of the Société Française d'Ophthalmologie in 1923 for his paper on the "Ocular Manifestations of Focal Infections." The Howe Medal in Ophthalmology was awarded to him in 1927 and the Huguenot Cross in 1928.

As a teacher, and especially as a lecturer he was unexcelled. His dignity and commanding appearance were augmented on all occasions at which he spoke by a choice of words and diction which held every audience. He was always in great demand as a public speaker, and his after-dinner speeches were modeled with the same care he gave to his scientific addresses. He was chosen to give the Bowman Lecture before the Ophthalmological Society of the United Kingdom in 1923, which was a signal honor for an American.

He belonged to every Ophthalmological Society of note in this country and abroad, and took an active part in directing the policies and growth of many of them. He was President of the College of Physicians of Philadelphia from 1910 to 1913, and was President of the American Ophthalmological Society in 1916. In 1922 he was elected President of the American Medical Association. He was elected a member of the American Philosophical Society in 1912.

In addition to writing over several hundred original papers on ophthalmological subjects he found time to write an outstanding text-book on diseases of the eye, which went through ten editions, and he was the co-author of a number of other similar texts. He was an indefatigable worker. In addition to all of his teaching and scientific work he took care of an enormous private practice. A great many of his patients were cases referred in consultation from all over the country, and his reports on these are noted for their keen analysis and wise conservative judgment.

His great devotion to his scientific work left him with few outside interests. He never married, and he had little time to give to social gatherings. His day began punctually at eight in the morning with his first private patient, and was seldom finished before midnight. During the evening hours he worked in his library, going over his reports on consultations and reading the latest books and periodicals on his work.

During the World War he entered the Army as a Major, and did meritorious work both here and abroad. After the war he became a member of the editorial board of "The Medical Department of the United States Army in the World War," and at the time of his death he held the rank of Brigadier General in the Medical Officer's Reserve Corps.

Dr. deSchweinitz's stately appearance, his forceful character unswerving in honesty, and his brilliant achievements have made his name a symbol, which represents all that is noblest in a truly great physician.

FRANCIS H. ADLER.

FREDERICK TILNEY

(1876-1938)

The desire to assist in "promoting useful knowledge" is expressed in the record of the life and in the scientific contributions of Frederick Tilney. His faith in the sagacity and wisdom of the guiding principle of the American Philosophical Society was evident in the way he lived and worked. Those who had the privilege of knowing him personally readily understood the extent to which his actions expressed the satisfaction and pleasure he derived from membership in the Society, to which he was elected in 1930.

He had a sincere and earnest desire to promote the kind of knowledge that would be useful both to himself and to others. His success in utilizing the knowledge he had acquired to overcome the handicaps that in 1924 were imposed by hemiplegia, the result of a cerebral thrombosis, was a noteworthy human achievement. When he died on August 7, 1938 at the age of 62, the Society lost a member whose life and work was an inspiring example of what can be accomplished by "promoting useful knowledge."

Quietly, unostentatiously, he tested the validity of his faith in the value of "promoting useful knowledge" of the brain and nervous

system by what he did as an investigator and physician. Any discrepancies between beliefs and action Tilney was quick to realize called for further investigation. He was satisfied and expected to have the meaning and significance of his scientific contributions interpreted by the way he worked and lived. His personal desire to investigate the structure of the brain and nervous system never restricted his vision so that he ignored or lost sight of Nature's experiment of humanizing man. To yield to the temptation to get wisdom without getting understanding, he regarded as unprofitable and dangerous.

Dr. Tilney was born in Brooklyn, New York, and was a pupil of the Brooklyn Polytechnic Institute until he entered Yale University from which he graduated in 1897. For two years before he decided to study medicine he engaged in newspaper work. In 1903 he received his medical degree from the Long Island College of Medicine. After serving as interne in the Kings County Hospital he practiced medicine in Brooklyn.

Early in his medical career a spirit of investigation turned his attention to research. The encouragement he received from his two teachers and friends, Drs. T. Mitchell Prudden and George S. Huntington, strengthened his desire to begin a long series of researches which were carefully planned and brilliantly executed. Starting as an Instructor in Anatomy at Columbia University in 1914, he became Associate Professor of Neurology and then in 1915 Director of the Department. This position he retained until his death.

Although Dr. Tilney's main scientific contributions were in the field of neurology and his advice as a neurologist was constantly sought for, he was not a specialist in any narrow sense. He gave a human touch to all he did as investigator, clinician, and as a man.

The results of his investigations added to the knowledge of important incidents in the evolution and growth of the human brain and nervous system. In the "Fossil Brains of Some Early Tertiary Mammals of North America" (1931), the "Brain Stem of Tarsius" (1928), and in "Brain from Fish to Man" (1935), the records of his observations threw light upon the problems both of cerebral structure and functions. A book with the title "The Form and Functions of the Central Nervous System" was prepared in collaboration with his associate, Dr. H. A. Riley. It was published in 1920 and marks an epoch in the development of neurology in this country.

In 1928 he published in two volumes the results of his study of the development of "The Brain from Ape to Man."

The titles of other publications, "Neurology and Education" (1920), "Study of Helen Keller's Sensory Equipment" (1928), Neuropsychiatry "The Master of Destiny" and "Social Progress" (1930), were evidence of his earnest desire to humanize knowledge with the understanding that is essential if man is to become more successful in using his large brain to construct and create instead of to destroy and to kill.

The kind of service Dr. Tilney gave to the American Neurological Association, and to The Neurological Institute of which he was Director until January 1938 when he retired, was as valuable as it was humanizing. Although he was physically strong, very vigorous and enjoyed the stimulus and inspiration obtained from competition and rivalry, he was equally alert to the need of cultivating the spirit of mutual support, assistance and cooperation. Deeply impressed by how large and complicated the human brain is, he tried to stimulate interest in learning to use this organ. Those who were handicapped in this great undertaking were encouraged and helped.

Although much of his time was spent in studying the structure and functions of the brain and nervous system, in describing lesions, growths and abnormalities, his chief objective was to get the understanding necessary in order to give a human value to his work, and to his relations with patients and all those with whom he came into contact. Eager to take life philosophically and to profit as much as he could from the use of scientific methods his paramount interest was to be human. Science and art he regarded as means and methods which if used wisely marked a step in advance towards the realization of human values. Present discontents and the "collapse of high-pitched expectations" did not shake his belief in human nature. He lived and worked as those do who expect that their actions and not their thoughts and words will be accepted as the final test of the validity and value of what they accomplish. His inextinguishable sympathy and interest in the progress of Nature's experiment of humanizing man prepared him to regard living as the only reliable and safe method to adopt in order to understand life.

STEWART PATON.

OTTO HILGARD TITTMANN

(1850-1938)

Dr. Otto Hilgard Tittmann, geodesist, was born in Belleville, Illinois, on August 20, 1850, and at the early age of 17 entered the service of the Coast and Geodetic Survey (then known as the Coast Survey), where he served throughout his active career of forty-eight years.

Taking every opportunity to profit by the experience and contacts in his early work as a subordinate, he steadily advanced through the successive assignments of added responsibility which were to qualify him for the important post of Superintendent (now designated Director), held by him from 1900-1915. His high standing in the scientific world is attested by the many important commissions given to him by his government on special assignments of duty in this and foreign countries.

His duties in the field service took him to many parts of the United States and Alaska, and in 1874 he was detailed as Assistant Astronomer on the expedition to Japan to observe the transit of Venus. Becoming deeply interested in standards of weights and measures he devoted much study to the problem and was placed in charge of the Office of Weights and Measures, then a part of the Bureau, from 1887 to 1895. During this period he was instrumental in obtaining standards which were sorely needed in this country and was appointed a member of a commission designated for the purpose of recommending standards and methods for use in the optical analysis of sugar. He was also sent on a special commission to Puerto Rico for the purpose, among other things, of setting up standards of weights and measures there.

In 1890 he was commissioned to inspect offices of weights and measures in Europe and to bring to the United States from Paris the National Prototype Meter No. 21 and Kilogramme No. 4 which are today in use at the National Bureau of Standards.

During his tenure of office the activities of the Coast and Geodetic Survey were increased in scope and importance in many directions. Outstanding contributions to our knowledge of the tides were made and a new tide-predicting machine was constructed in the Bureau's shops which is today unexcelled.

Under his leadership there were also developed the wire drag for the location of submerged obstructions at sea, dangerous to

navigation, the precise leveling instrument still considered to be without an equal for speed and accuracy, and the use of invar tapes for precision base measurements. The scope of work in the field of terrestrial magnetism was enlarged during his administration and permanent observatories were established at several points in the United States and possessions for the inauguration of a long-range magnetic program.

His concept of the function of geodesy in the extension of control so necessary for national mapping and for many engineering and scientific purposes and also with regard to Federal responsibility, was the same as generally accepted today.

Regarding this problem, Dr. Tittmann wrote:

"Secondly, the admeasurement of these areas is far beyond the reach of individual enterprise and can only take place when the practical needs of governments suggest the utility of great mensurational surveys which at the same time and without great additional expense will furnish the data required for a more perfect knowledge of the spheroid."

* * *

"The history of geodesy is full of instances of confusion and wasted energy due to the lack of a common standard, and the results of many arc measures which would at least have great historic interest are utterly lost to us, because we cannot make even a respectable guess at the units used. The adoption of an international unit of length and its necessary auxiliary, a common thermometric scale, and the provision which the various governments made for the reference of their measuring apparatus to a common unit was a step of fundamental importance."

Dr. Tittmann saw the many advantages to be gained from having all the triangulation of the continent on the same datum and to this end he was influential in obtaining the joint action between the United States, Canada and Mexico that led to the adoption of the U. S. Standard Datum as the datum for the triangulation of those countries and to the change of the name to North American Datum in keeping with its international character. This was a very far-sighted step and has eliminated the confusion that usually exists where triangulation nets of neighboring countries meet at common points. It was also possible through this action and with the cooperation of Canada to place the triangulation of Alaska on the same datum. Recognizing the international importance of geodesy, Dr. Tittmann maintained throughout his career a very

close contact with the International Geodetic Association and several times represented his country at international meetings. It was through the International Geodetic Association that the international latitude observatories at Ukiah, Calif., and Gaithersburg, Md., were established to be operated under his supervision as a part of the international cooperative project of maintaining a total of 5 stations in various parts of the world for making systematic observations of latitude variations and studying the wobble of the earth's pole.

While Superintendent of the Coast and Geodetic Survey, he represented the United States on the International Boundary Commission from 1901 to 1915. In 1903 he was delegated as a technical expert for the United States before the Alaskan Boundary Tribunal in London. An authority on such matters, his appointment as sole Commissioner in 1908 was only natural and necessary in order that the best known geodetic methods might be applied to the very broad problem of laying down the international boundary between the United States and Canada and between Alaska and Canada. Under his supervision the greater part of all of our northern boundary was surveyed or resurveyed, adequately marked and mapped. Few countries are so fortunate as to have a boundary of such high character. The technique for boundary surveying was developed by him and by members of the Commission's organization to such a high degree of perfection as to become the model for modern boundary surveying and demarcation throughout North America. He wisely demanded that the boundary positions and triangulation points be firmly marked and that the geodetic positions be determined with an accuracy sufficient for all time. As early as 1910 he prophesied the use of air transport as an aid to surveying, and regretted that air navigation had not progressed sufficiently to allow for its use on the boundary in Alaska, particularly from Mt. St. Elias to the Arctic Ocean.

In a paper dealing with these problems written in 1908, Dr. Tittmann said:

"It is worthy of remark in passing that the tracing of a meridian or parallel on the ground involves considerations which do not become apparent by an inspection of an artificial globe on which these lines are traced as smooth and regular curves. A parallel of latitude must be determined by astronomical observations, but in general the circumference of a small circle of the earth

parallel to the equator will not lie in the same astronomical latitude, owing to the so-called deflection of the vertical. A series of points determined astronomically as being in the same latitude or, as in the case of a meridian, in the same longitude, will therefore in general produce on the surface of the earth a zig-zag line when they have been joined together.

"In order to avoid all questions that might arise from local deflections of the zenith, it was provided by the Treaty of 1906 that the commissioners should determine by the telegraphic method a convenient point on the 141st meridian and then trace a north and south line passing through the point thus ascertained."

Dr. Tittmann was the author of numerous official publications and of many articles contributed to magazines and newspapers concerning the work of the Coast and Geodetic Survey, the work of the International Boundary Commission and also regarding standards of weights and measures.

He was given honorary degrees of Doctor of Science by Stevens Institute and Washington University, and the degree of Doctor of Laws by George Washington University. His scientific mind and interest brought him into association with leaders of science in many fields. He was one of the founders of the National Geographic Society and its President from 1915 to 1919; a founder member of the Cosmos Club and President in 1904; President of the Washington Academy of Sciences, 1913; President of the Philosophical Society of Washington in 1899; and member of the American Philosophical Society (elected 1906), the American Association for the Advancement of Science, the American Meteorological Society and the American Society of Civil Engineers.

By all who knew him, Dr. Tittmann was recognized as a man of the highest character, upright and fair in all his dealings, an able scientist, a true friend and a valued associate.

He retired from public office in 1915 and lived at his home in Leesburg, Va., until his death on August 21, 1938. On August 24 he was interred in the cemetery at Leesburg by the side of his wife, who had preceded him by only a few months. He is survived by his son, Charles Trowbridge Tittmann, Washington, D. C.

CLEMENT L. GARNER.

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